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Results from the 2012 and 2013 sentinel bottom-trawl surveys in the southern Gulf of St. Lawrence and comparisons with previous 2003 to 2011 surveys

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

A sentinel bottom-trawl survey was undertaken in NAFO division 4T each August from 2003 to 2013. This survey used a stratified-random sampling design along with standardized fishing protocols. Four commercial vessels participated each year. Formal statistical tests revealed significant differences in relative fishing efficiency between vessels. Estimates of relative efficiency were used to adjust catch levels with respect to a reference vessel. Length frequency distributions of fish caught by each vessel were also compared informally. Standardized abundance indices, total length frequencies, and maps of annual catch distribution are presented for commercial groundfish species (Atlantic cod, white hake and various flatfish) and for some pelagic species (Atlantic herring, gaspereau and rainbow smelt). Since 2003, there have been declines in the abundance of Atlantic cod, American plaice, winter flounder and yellowtail flounder, and a slight decrease in white hake abundance. The abundance of pelagic species and Atlantic halibut varied without trend over the same period.

RÉSUMÉ

Un relevé de pêche sentinelle au chalut de fond a été effectué dans la division 4T de l'OPANO annuellement en août de 2003 à 2013. Ce relevé est effectué sur un plan d'échantillonnage stratifié aléatoire avec un protocole de pêche standardisé. Quatre navires commerciaux participent au relevé à chaque année. Des tests statistiques formels ont démontré des effets significatifs pour l'efficacité de capture relative entre les navires. Les estimations de l'efficacité relative ont été utilisées pour ajuster le niveau des prises en fonction d'un navire de référence. Des comparaisons informelles des fréquences de longueur des prises de chaque navire ont été effectuées et présentées. Les indices d'abondance standardisés, les fréquences de longueur totale et la distribution des prises annuelles sont présentés pour les espèces commerciales de poissons de fond (la morue franche, la merluche blanche, et divers poisson plats) et pour des espèces de poissons pélagiques (le hareng atlantique, le gaspareau et l'éperlan d'Amérique). Depuis 2003, il y a eu une baisse de l'abondance de la morue, la plie canadienne, la plie rouge et la limande à queue jaune et une légère diminution de l'abondance de la merluche blanche. L'abondance des espèces pélagiques et de flétan atlantique ont varié sans présenter de tendance durant la même période.

1. INTRODUCTION

Following the collapse of several groundfish stocks in the Northwest Atlantic, sentinel surveys were introduced to the southern Gulf of St. Lawrence (sGSL) in 1994 as a way of obtaining complementary data to that obtained from a multi-species bottom-trawl research vessel (RV) survey conducted each September since 1971. Sentinel surveys were also intended to involve fish harvesters in the scientific assessment process and have incorporated certain elements of the contemporary fishing fleet, namely the timing of survey, the various types of fishing gears used by the fleet, as well as being performed by active commercial groundfish fish harvesters and their vessels.

The main objective of these surveys has been to gather information on stock composition and distribution, and to construct indices from which to infer trends in abundance. When used in conjunction with other survey data, other results may be derived, such as detecting changes in migration patterns for a given species. Currently, there are two types of sentinel surveys in the sGSL: the fixed gear survey which uses longlines, and the sentinel mobile (SM) survey which uses bottom-trawls. The SM survey was initiated in 2003, following an internal review of the sentinel program (Gillis 2002). Since its inception, the survey has followed the stratified-random design used for the Fisheries and Oceans Canada (DFO) September multi-species survey. This report focuses on the surveys for the 2003 to 2013 period.

This report provides a summary of results from the 2012 and 2013 SM surveys conducted between August 1st and August 21st. These results are compared to results from the 2003 to 2011 SM surveys. Standardized abundance indices, total length frequencies, and maps of annual catch distribution are presented for the commercially-fished groundfish, namely, Atlantic cod (*Gadus morhua*), white hake (*Urophycis tenuis*), American plaice (*Hippoglossoides platessoides*), witch flounder (*Glyptocephalus cynoglossus*), winter flounder (*Pseudopleuronectes americanus*), yellowtail flounder (*Limanda ferruginea*), and Atlantic halibut (*Hippoglossus hippoglossus*), as well as commercially-fished pelagic species, namely, Atlantic herring (*Clupea harengus*), gaspereau (*Alosa pseudoharengus*) and rainbow smelt (*Osmerus mordax mordax*).

There are four commercial fishing vessels that participate in the annual SM survey, each fishing the same type of trawl. However, some of the vessels have changed between years such that eight vessels have been used in the survey since 2003 (Table 1). The relative fishing efficiency of each vessel was estimated and used to standardize catch indices for each species in the cases where the effect was found to be significant. The consistency of observed tow distances for each vessel is also presented and discussed (Table 2).

2. METHODS

From 2003 to 2013, the SM survey was undertaken annually by four commercial otter-trawlers fishing in overlapping areas. However, some of the vessels changed between years such that eight vessels have been used since the inception of the survey. Vessels are chosen such that there is one participant from each of the following geographic regions: Prince Edward Island, Gaspe, Magdalen Islands and New Brunswick. The study area, which covered most of the NAFO division 4T fishing area, was sampled using the same stratified random sampling design used for the annual September RV survey (Figure 1). The size and shape of the strata were selected based on water depth and geographic area. In 2012 and 2013, a total of 180 and 172 sampling stations respectively were randomly chosen and divided among the strata (Figure 1). Since 2006, the four participating fishing vessels have been randomly assigned stations in each

stratum. Efforts have been made to ensure that vessels have the same numbers of sample sites within each stratum. This improved the estimates of each vessel's relative fishing efficiency.

The names and physical characteristics of the otter-trawlers that participated in the survey are presented in Table 1. Since 2003, there have been four vessel changes: in 2004 the *Viking II* replaced *L'Alberto*, in 2006 the *Cap Adèle* replaced the *Manon Yvon*, the in 2007 the *Atlantic Quest I* replaced the *Riding It Out* and in 2010 the *Atlantic Quest I* replaced by the *Tamara Louise*. The same trawl, a 300 Star Balloon, has been used by all vessels since 2003.

The target fishing procedure at each sampling station consisted of a 30-minute trawl tow (with acceptable minimum tow duration of 20 minutes) at an approximate speed of 2.5 knots. A standard tow length was thus considered to be 1.25 nautical miles long. Fishing was limited to daylight hours between 06:00 hrs and 20:30 hrs (sunrise and sunset, Atlantic Standard Time) to minimize day/night effects for certain species (Benoît and Swain 2003; Casey and Myers 1998). Tow distances estimated as the difference between the start and end positions and multiplying the speed and duration of each tow were compared to try and detect possible errors.

Data were collected by two fisheries observers on board each vessel. At each station, the tow start and end locations, the boat speed, the tow duration, as well as other relevant data were recorded. Details on the catch from each tow were also recorded: all fish and invertebrate species were sorted, weighed and counted. The length of up to 250 specimens was measured in each tow for each of the following species: cod, white hake, American plaice, Atlantic halibut, witch flounder, winter flounder, yellowtail flounder and Atlantic herring. Otoliths were collected from among the measured cod (one per centimeter) and white hake (one per centimeter per sex).

3. ANALYSIS

Observed catches (counts and weights) were scaled to a standard tow length of 1.25 nautical miles. For each fish species, the relative fishing efficiency of each vessel (E) was estimated and tested using the following Poisson regression model (SAS Proc GENMOD):

$$E[Yijkl] = \mu ijk = \exp(\alpha + \beta i + \gamma j + \delta k)$$

$$Var[Yijkl] = \Phi \mu ijk$$

Here Yijkl represents individual standardized count or weight observations, where i indexes the year, j indexes the stratum, k indexes the vessel and l indexes the catch for each combination of year, stratum and vessel. The α parameter corresponds to the intercept, the βi parameter corresponds to the year effect, the γj parameters corresponds to the stratum effect and the δk parameters corresponds to the vessel effect. The Φ parameter is used to account for overdispersion (a larger than expected variance given the model and data). The model was fitted using a quasi-likelihood approach.

Previous studies have shown the inadequacy of similar models for testing the significance of vessel effects (Benoît and Swain 2003; Casey and Myers 1998). Therefore randomization tests were performed to validate the significance of vessel effects. Catches occurring within a given stratum and year were permuted (i.e. randomly assigned) among the vessels fishing within the stratum. The above Poisson model was then fitted to the permuted data set. This process was repeated for one thousand iterations, which defined a simulated null distribution from which a corrected probability value of the original model was derived. Where vessel effects were determined to be statistically significant with respect to weight per tow, further hypothesis tests were performed using the original model to determine which vessels could be grouped together under the same relative fishing coefficient. Under the assumed grouping, coefficients were then

recalculated for both numbers and weights and subsequently used for all analyses requiring standardization. The reference vessel was chosen to be the *Miss Lamèque*, as it is the only vessel to have remained in the program since 2003. This procedure was applied to the data from 2003 to 2013; consequently the present estimated relative efficiency values may differ from past estimates.

Annual catch length frequency distributions were constructed from individual vessel length frequencies and were adjusted for relative fishing efficiencies where appropriate.

4. RESULTS

4.1. THE 2012 AND 2013 SURVEYS

The 2012 survey consisted of 177 valid sets and 9 invalid sets and the 2013 survey consisted of 170 valid sets and 8 invalid sets (invalid sets are not used for any analyses). Sets were deemed invalid if there was extensive gear damage, if crab or lobster traps were caught in the net, if the set duration was less than 20 minutes, or if a set was too far from the specified sampling location. The summary of set statistics by vessel can be found in Table 2.

The 2012 and 2013 total catches in number and weight for all species are given in Appendix I and II and the species specific mean numbers and weights by stratum are shown in Appendix III and IV.

All of the vessels that participated in the 2012 and 2013 surveys had observed tow distances, as determined from start and end coordinates, that correlated strongly with the calculated tow distances, obtained by multiplying boat speed and tow duration. Each vessel had a small proportion of valid tows with durations between 20-29 minutes. The *Viking II* and the *Tamara Louise* had a larger proportion of shortened tows (Figure 2a and 2b).

4.2. COD

The geographic distribution of cod catches, in 2012 and 2013, was similar to that observed in previous years (Figure 3). Since 2009, cod densities observed north of Prince Edward Island, south of Shediac Valley and east of the Magdalen Islands have remained at low levels compare to previous years. Generally, cod was caught north of Shediac Valley, off the coast of Gaspé, on the Orphan Bank and in the Cape Breton Trough. Relatively few cod were caught on Bradelle Bank (stratum 423) and St. Georges Bay (stratum 403).

The randomization test suggested significant vessel effects (P = 0.003) for catch weights (Table 3). The *Cap Adèle*, the *Viking II* and the *Manon Yvon* had similar vessel effects, with a common relative fishing efficiency estimated at 1.38 by weight and 1.50 by numbers per tow compared to the reference vessel. The *Riding It Out*, the *Atlantic Quest I* and the *Tamara Louise* had similar vessel effects among themselves, estimated at 0.55 for catch weight and 0.59 for numbers per tow.

The mean catch rates of cod show an overall decreasing trend from 2003 to 2013 (Table 4; Figure 4). The adjusted mean catch rate of cod in the 2013 survey was 14.6 fish or 6.8 kg per tow.

In 2013, 68% of catches were composed of cod between 30 and 50 cm which is comparable with the long term trend (Figure 5). The highest catch rates occurred between lengths of 33 and 41 cm for 2013, consisting largely of cod aged 4 and 5 years. From one year to another, year-classes for lengths smaller than 43 cm are easily observed, but can not be tracked beyond this size. Due to the size of the mesh used, almost no cod less than 20 cm in size were caught.

The average length of cod varied without trend over the 2003-2013 period (Table 5; Figure 6). Compared to the 2003-2007 period, the abundance of fish from most sizes decreased in the most recent period (Figure 7).

4.3. WHITE HAKE

The geographic distribution of white hake catches, in 2012 and 2013, was similar to that observed in previous years (Figure 8). As in previous years, very few white hake were caught outside the deep-water strata along the Laurentian Channel and northwest of Cape Breton (strata 415, 425, 437, and 439).

The randomization test suggested significant vessel effects (P = 0.001) for catch weights (Table 3). Five vessels were found to be significantly different from the reference vessel, the *Miss Lamèque*, but four of them were not significantly different amongst each other. The estimated relative catch coefficient for the *Cap Adèle*, *L'Aberto*, the *Viking II* and the *Atlantic Quest I* was 2.74 for weight and 3.42 for numbers per tow. The estimated corresponding values for the *Manon Yvon* were 5.33 and 5.78. Given the initial confounding of vessel and stratum effects in earlier survey years and the sparseness of white hake catches, the above estimates of vessel effects must be interpreted with some caution.

The mean catch rates of white hake show an overall decreasing trend from 2003 to 2013 (Table 6; Figure 9). The adjusted mean catch rate of white hake in the 2013 survey was 0.22 fish or 0.10 kg per tow, at or near the lowest level observed in the 11-year record.

Because of the scarcity of catches, the length frequency distributions are somewhat irregular and tracking of recruitment modes is not possible (Figure 10).

The average length of white hake has varied without trend during the 2003-2013 period (Table 7; Figure 11). Abundance of fish, from all sizes, decreased since 2008 (Figure 12).

4.4. AMERICAN PLAICE

The geographic distribution of American plaice catches in 2012 and 2013 was similar to that observed in previous years (Figure 13). They were widely distributed across NAFO division 4T but since the late 2000s, their densities observed north and east of Prince Edward Island, south of the Shediac Valley and west of Cape Breton have decreased to low levels compared to previous years.

The randomization test suggested significant vessel effects (P = 0.001) for American plaice (Table 3). Pairwise comparisons suggested that the *Cap Adèle* and the *Manon Yvon* were significantly different from the reference vessel, the *Miss Lamèque*, but were not significantly different from one another. The estimated relative catch coefficients were 2.08 for numbers and 2.06 for weight per tow.

The mean catch rates of American plaice show an overall decreasing trend from 2003 to 2013 (Table 8; Figure 14). The adjusted mean catch rate of American plaice in the 2013 survey was 10.21 fish or 1.65 kg per tow, the lowest level observed in the 11-year record.

Little change was observed in the relative size composition for American plaice from this survey. In 2013, 74% of catches were composed of plaice between 20 and 30 cm which is comparable with the long term trend (Figure 15).

The average length of plaice has varied little during the 2003-2013 period (Table 9; Figure 16). Abundance of fish, from all sizes, decreased since 2008 (Figure 17).

4.5. WITCH FLOUNDER

Witch flounder were caught along the deep-water strata off Gaspé and the Laurentian Channel, with the largest concentration of catches occurring north of Magdalen Islands and in the Cape Breton Trough (Figure 18). The spatial distribution, for 2012 and 2013, was similar to that observed in previous surveys.

The randomization test suggested significant vessel effects (P = 0.034) for witch flounder catch weights (Table 3). The data was not adjusted, given the initial confounding of vessel and stratum effects in earlier survey years and the sparseness of witch flounder catches, the data were not adjusted

The mean catch rates of witch flounder have been relatively steady since 2007 at around 1.4 fish and 0.4 kg per tow. However, these catch rates are lower than those observed from 2003 to 2006 (Table 10; Figure 19).

The catch composition for witch flounder from this survey is mainly composed of fish ≥30 cm (Figure 20). In 2013, 4% of the catch was composed of fish ≤25 cm.

The average length of witch flounder has varied little during the 2003-2013 period. (Table 11; Figure 21). Abundance of fish, from all sizes, decreased since 2008 (Figure 22).

4.6. WINTER FLOUNDER

The spatial distribution of winter flounder has remained similar since 2003 (Figure 23). It was distributed in the shallow coastal strata of NAFO division 4T, off northeastern New Brunswick, around the Magdalen Islands and Prince Edward Island and in St. Georges Bay. Since 2010, their densities observed around Prince Edward Island, south of Shediac Valley and in St. Georges have decreased to low levels compared to previous years.

The randomization test suggested significant vessel effects (P = 0.004) for catch weights (Table 3). Pairwise comparisons suggest that the *Cap Adèle* and the *Manon Yvon* were significantly different from the reference vessel, the *Miss Lamèque* but not with each other. The estimated relative fishing coefficients for the *Cap Adèle* and the *Manon Yvon* was 2.93 for weight and 3.36 for numbers per tow. The *Tamara Louise* was also different from the reference vessel. The estimated relative fishing coefficient for this vessel was 0.21 for weight and 0.18 for numbers per tow.

The adjusted mean catch rate of winter flounder has declined since the start of the survey in 2003. This index was at the lowest levels on record in 2012 and 2013, averaging 3% of the 2003 value in these two years (Table 12; Figure 24). Interpretations of a decline must be tempered with the fact that winter flounder is a coastal species whose distribution stretches to the coastline. Therefore there is a broad, shallow area of winter flounder habitat that is not sampled by the survey and fluctuations in the index may be due to changes in spatial distribution with respect to the boundaries of the study area.

No change was observed in the relative size composition for winter flounder from this survey. In 2013, 68% of catches were composed of fish between 20 and 30 cm which is comparable with the long term trend (Figure 25).

The average length of winter flounder has varied without trend during the 2003-2013 period (Table 13; Figure 26). Abundance of fish, from all sizes, decreased since 2008 (Figure 27).

4.7. YELLOWTAIL FLOUNDER

Yellowtail flounder were found in the shallow-water strata of NAFO division 4T, with the greatest numbers observed east of the Magdalen Islands and north of Prince Edward Island (Figure 28).

The randomization test suggested significant vessel effects (P = 0.001) for catch weights (Table 3). Pairwise comparisons suggested that the *Tamara Louise* was significantly different from the reference vessel, the *Miss Lamèque*. The estimated relative fishing coefficient was 0.28 for weight and 0.23 for numbers per tow. The *Cap Adèle* was also different from the reference vessel. The estimated relative fishing coefficient for this vessel was 2.06 for weight and 2.06 for numbers per tow.

The adjusted mean catch rates of yellowtail flounder decreased over the 2003-2013 time series, with the value in 2013 being the lowest level observed in the 11-year record (Table 14; Figure 29).

The catches of yellowtail flounder from this survey are mainly composed of fish between 15 and 30 cm (Figure 30). In 2013, 13% of the catch was composed of fish ≥25 cm, which is considerably smaller than in past years.

The average length of yellowtail flounder was stable between 2003 and 2007, but has since shown a decrease (Table 15; Figure 31) due to a decrease in the abundance of larger fish (≥25 cm) in the catch (Figure 32).

4.8. HERRING

Atlantic herring was mainly found in the shallow-water strata of NAFO division 4T, in Chaleur Bay around Prince Edward Island, in St. Georges Bay and in the Cape Breton Trough (Figure 33). Since 2010, their densities observed around Prince Edward Island, have decreased compared to previous years. Herring are a pelagic, coastal species, with the main catches occurring in near shore areas. Thus, fluctuations in the index may be due to changes in spatial distribution with respect to the study area boundaries and/or catchability of the trawl depending on the location of herring schools in the water column.

The randomization test suggest a significant vessel effects (P = 0.045) for herring catch weights (Table 3). Pairwise comparisons suggested that *L'Alberto* was significantly different from the reference vessel, the *Miss Lamèque*. Since this vessel was the only one found to be different from the others because of one tow with a large catch of herring no adjustments were made to the mean catch rate values.

The mean catch rates for herring in 4T have fluctuated without trend during the 2003 to 2013 period (Table 16; Figure 34). In 2013, the abundance and the biomass index were under the long-term average (90.3 fish per tow and 16.6 kg per tow).

The catches of herring in this survey are mainly composed of fish between 20 and 30 cm (Figure 35). In 2013, this group of fish represented 94% of the catch.

The average length of herring was low in 2010 and 2011 but has increased somewhat since (Table 17; Figure 36). This pattern reflects due to a decrease in the abundance of larger fish (≥30 cm) in the catch when comparing the 2007-2009 and 2010-2013 period (Figure 37).

4.9. ATLANTIC HALIBUT

Vessel coefficient estimation comparisons between vessels were performed for Atlantic halibut but not taken into consideration given the sparseness of available catch data.

Atlantic halibut catches occurred in the Cape Breton trough and along the Laurentian Channel, north of the Bradelle Bank and off Gaspé (Figure 38).

The abundance and biomass indices for Atlantic halibut have varied without trend since 2003 (Table 18; Figure 39). Confidence intervals for the annual estimates are relatively large in all years.

Given that very few Atlantic halibut are caught in any given year and that fishermen have been required to return their halibut catches to the water since 2007, no length frequency distributions were available.

4.10. GASPEREAU

Gaspereau was mainly found in the shallow-water strata of NAFO division 4T, in the Northumberland Strait and northwest of Prince Edward Island but also in the Shediac Valley and Chaleur Bay for some years (Figure 40). Gaspereau is a pelagic, coastal species, with the main catches occurring in near shore areas. Thus, fluctuations in the index may be due to changes in spatial distribution with respect to the study area.

There were no statistically significant differences in fishing efficiency between vessels ($P = 0.767$) for gaspereau catch weights, thus catch data were not adjusted (Table 3).

Few discernible trends are apparent across the 2003 to 2013 survey indices, with most years having similar catch except for 2009 where the catch rates were 13 times higher than the other years (Table 19; Figure 41). Confidence intervals for the annual values are relatively large in all years.

Given that observers were not required to measure gaspereau catches, no length frequency distributions are available.

4.11. RAINBOW SMELT

Rainbow smelt was mainly found in the shallow-water strata of NAFO division 4T, in the Northumberland Strait, the coastal waters of Prince Edward Island, in Shediac Valley, Chaleur Bay and St. Georges Bay (Figure 42). Rainbow smelt is a pelagic, coastal species, with the main catches occurring in near shore areas. Thus, fluctuations in the index may be due to changes in spatial distribution with respect to the study area boundaries.

There were no statistically significant differences in fishing efficiency between vessels ($P = 0.068$) for rainbow smelt catch weights, thus catch data were not adjusted (Table 3).

The abundance and biomass indices for rainbow smelt varied without trend from 2003 to 2013 (Table 20; Figure 43).

Given that observers were not required to measure rainbow smelt catches, no length frequency distributions are available.

5. DISCUSSION

For some species, such as cod and American plaice, which occur throughout the southern Gulf, the overlap of fishing areas was sufficient to calibrate the vessels with some degree of confidence (i.e. from year to year and from vessel to vessel). However, for other species, such as white hake and witch flounder, which have a more restricted spatial distribution resulting in fewer catches overall and limited overlap in fishing areas between vessels, there is a high potential for confounding of vessel and stratum effects. The length of the time series is such that present vessel effect estimates are more stable than those from earlier analyses (same

participating vessels and fish harvesters since 2006). However, we cannot improve the estimation of relative fishing efficiency of vessels no longer active in the survey, such as the *L'Alberto* and the *Manon Yvon*.

The possibility of size-dependent relative fishing effects was not explored using the analytical model. Given that we are interested in possible vessel differences as measured inter annually the comparisons based on all the relevant data from all years for some pair will be interested to look at. There would be less influence of stochasticity and we could actually begin to see true size-dependent differences in vessel efficiency.

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TABLES

Table 1. Characteristics of otter-trawlers that participated in the NAFO division 4T sentinel bottom-trawl survey since 2003.

Vessel	*CFVN*	*Region*	*Years of participation*	*Overall Length*	*Gross Tonnage*	*Horse-power*	*Year Built*	*Hull Type*
L'Alberto	11873	Gaspé, QC	2003	55' 4"	62	600	1987	Wood
Manon Yvon	17354	îles de la Madeleine, QC	2003-2005	66'	80	500	1987	Steel
Atlantic Quest I	64796	Prince Edward Island, PEI	2007-2009	62'	62	500	1972	Fibreglass
Riding It Out	5688	Prince Edward Island, PEI	2003-2006	58'	67	470	1981	Wood
Tamara Louise	100278	Prince Edward Island, PEI	2010-2013	44.11'	35	470	1986	Fibreglass
Miss Lamèque	151347	New Brunswick, NB	2003-2013	44'	34	350	1987	Aluminum
Viking II	17790	Gaspé, QC	2004-2013	55' 4"	62.24	500	1989	Fibreglass
Cap Adèle	11870	îles de la Madeleine, QC	2006-2013	58'	53.5	450	1986	Fibreglass

Table 2. Summary of set statistics by vessel for the 2012 and 2013 NAFO division 4T sentinel bottom-trawl surveys.

Vessel	*Tamara Louise*		*Cap Adèle*		*Viking II*		*Miss Lamèque*	
Year	*2012*	*2013*	*2012*	*2013*	*2012*	*2013*	*2012*	*2013*
Number of valid tows	41	39	40	37	53	59	43	35
Mean tow speed (knots)	2.50	2.50	2.53	2.57	2.57	2.53	2.53	2.50
Mean tow duration (min)	27.80	28.21	29.60	28.86	28.77	28.93	29.47	30.03
Mean calculated distance (nm)	1.16	1.18	1.25	1.24	1.23	1.22	1.24	1.18
Mean observed distance (nm)	1.08	1.13	1.34	1.27	1.21	1.18	1.23	1.13

Table 3. Significance levels (P value based on randomization test) by species for the null hypothesis that the vessel effects are equal based on an analysis of catches from 2003 to 2013.

Species	Mean weight per tow	Mean number per tow
Cod	0.003	0.001
White hake	0.001	0.001
Atlantic halibut	0.004	0.037
American plaice	0.001	0.001
Witch flounder	0.034	0.022
Yellowtail flounder	0.001	0.001
Winter flounder	0.004	0.001
Herring	0.045	0.002
Gaspereau	0.767	0.694
Rainbow smelt	0.068	0.016

Table 4. Annual indices (mean, 2 standard errors) for Atlantic cod by numbers and weight per tow in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Number				Weight (kg)			
	Mean		2 Standard errors		Mean		2 Standard errors	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
2003	74.21	74.99	19.29	17.92	47.10	47.83	11.79	11.76
2004	76.28	68.69	24.22	22.45	39.83	36.20	11.86	10.62
2005	44.65	37.98	11.54	9.16	24.52	21.72	6.23	5.31
2006	35.07	28.23	13.06	10.65	21.64	18.17	7.61	6.52
2007	46.05	41.60	27.80	27.20	26.62	25.12	11.92	12.55
2008	45.88	39.72	18.58	16.41	31.50	27.70	18.35	14.29
2009	53.60	47.32	32.43	25.52	26.20	23.86	11.42	9.40
2010	22.20	19.83	11.25	8.84	12.87	11.91	4.89	4.39
2011	27.14	24.37	13.98	14.05	14.68	13.50	7.90	7.78
2012	17.59	12.84	7.20	4.78	10.26	8.15	4.22	3.10
2013	21.59	14.60	14.09	9.37	9.21	6.78	5.02	3.64

Table 5. Annual length indices (mean, 2 standard errors; cm) of Atlantic cod in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Length (cm)	
	Mean	2 Standard errors
2003	37.68	24.01
2004	35.15	22.53
2005	37.62	17.98
2006	39.06	17.58
2007	38.19	17.21
2008	39.28	25.75
2009	35.54	20.46
2010	37.20	22.09
2011	37.53	22.09
2012	36.71	22.75
2013	34.59	19.42

Table 6. Annual indices (mean, 2 standard errors) of white hake by numbers and weight per tow in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Number				Weight (kg)			
	Mean		2 Standard errors		Mean		2 Standard errors	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
2003	2.41	0.97	1.81	0.62	1.10	0.56	0.66	0.35
2004	2.58	0.79	1.52	0.35	1.65	0.65	0.96	0.31
2005	2.97	0.88	1.98	0.43	1.57	0.49	1.05	0.26
2006	2.33	0.99	1.64	0.64	0.98	0.48	0.53	0.24
2007	1.56	0.51	1.04	0.31	0.72	0.28	0.44	0.16
2008	0.86	0.51	0.53	0.39	0.40	0.25	0.20	0.14
2009	1.84	0.58	1.34	0.39	1.21	0.47	0.80	0.29
2010	1.17	0.57	0.70	0.33	0.54	0.31	0.28	0.17
2011	0.79	0.36	0.38	0.26	0.43	0.24	0.22	0.17
2012	0.58	0.20	0.66	0.20	0.26	0.11	0.17	0.07
2013	0.74	0.22	0.60	0.18	0.26	0.10	0.20	0.07

Table 7. Annual length indices (mean, 2 standard errors; cm) of white hake in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Length (cm)	
	Mean	2 Standard errors
2003	36.35	21.59
2004	40.04	19.18
2005	37.19	17.49
2006	35.57	15.66
2007	36.61	17.84
2008	37.63	15.92
2009	39.81	15.59
2010	36.70	19.62
2011	38.62	16.49
2012	35.30	22.40
2013	34.08	19.53

Table 8. Annual indices (mean, 2 standard errors) of American plaice by numbers and weight per tow in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Number				Weight (kg)			
	Mean		2 Standard errors		Mean		2 Standard errors	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
2003	61.77	47.03	13.89	9.75	12.07	9.35	2.67	1.94
2004	68.10	52.52	12.04	8.87	13.09	10.03	2.31	1.59
2005	44.93	37.40	11.72	9.74	7.48	6.03	1.44	1.04
2006	42.81	32.26	11.10	7.21	7.93	5.99	1.93	1.25
2007	38.64	26.02	11.40	6.43	7.28	4.99	2.06	1.20
2008	34.65	25.65	8.76	5.95	6.67	4.97	1.63	1.10
2009	27.81	23.12	7.85	6.84	5.18	4.29	1.50	1.24
2010	20.46	16.52	6.14	4.46	3.68	3.03	0.99	0.73
2011	35.81	25.34	15.44	8.31	6.14	4.40	2.45	1.36
2012	31.99	24.54	10.79	8.77	5.39	4.18	1.79	1.50
2013	12.06	10.21	4.38	3.75	1.98	1.65	0.66	0.52

Table 9. Annual length indices (mean, 2 standard errors; cm) of American plaice in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Length (cm)	
	Mean	± 2 Standard errors
2003	27.73	10.51
2004	27.34	10.59
2005	26.68	11.12
2006	27.06	9.94
2007	27.64	9.38
2008	27.80	9.85
2009	27.77	9.47
2010	26.95	10.33
2011	26.62	10.28
2012	26.33	10.19
2013	26.87	9.73

Table 10. Annual indices (mean, 2 standard errors) of witch flounder by numbers and weight per tow in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Number				Weight (kg)			
	Mean		2 Standard errors		Mean		2 Standard errors	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
2003	1.69	n/a	0.96	n/a	0.49	n/a	0.30	n/a
2004	2.33	n/a	1.14	n/a	0.79	n/a	0.36	n/a
2005	2.31	n/a	0.95	n/a	0.63	n/a	0.24	n/a
2006	3.10	n/a	2.61	n/a	0.86	n/a	0.74	n/a
2007	1.14	n/a	0.60	n/a	0.34	n/a	0.18	n/a
2008	1.36	n/a	0.72	n/a	0.34	n/a	0.18	n/a
2009	1.61	n/a	0.86	n/a	0.46	n/a	0.27	n/a
2010	1.46	n/a	0.76	n/a	0.37	n/a	0.18	n/a
2011	0.72	n/a	0.27	n/a	0.19	n/a	0.07	n/a
2012	1.48	n/a	0.81	n/a	0.42	n/a	0.19	n/a
2013	1.47	n/a	0.69	n/a	0.38	n/a	0.17	n/a

Table 11. Annual length indices (mean, 2 standard errors; cm) of witch flounder in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Length (cm)	
	Mean	2 Standard errors
2003	33.60	10.65
2004	35.22	10.44
2005	33.63	11.13
2006	34.53	8.27
2007	34.02	9.43
2008	33.25	9.01
2009	33.65	9.53
2010	32.78	9.95
2011	34.34	8.77
2012	33.45	11.32
2013	33.45	8.56

Table 12. Annual indices (mean, 2 standard errors) for winter flounder by numbers and weight per tow in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Number				Weight (kg)			
	Mean		2 Standard errors		Mean		2 Standard errors	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
2003	14.33	10.15	7.32	4.51	3.49	2.51	1.84	1.06
2004	10.40	5.81	6.23	2.38	2.30	1.42	1.18	0.51
2005	6.07	5.43	3.72	3.74	1.31	1.20	0.86	0.87
2006	3.16	2.36	0.99	0.82	0.69	0.53	0.22	0.18
2007	3.12	1.88	1.97	0.80	0.69	0.45	0.41	0.20
2008	2.20	1.27	1.01	0.51	0.47	0.31	0.22	0.13
2009	4.40	3.06	3.04	2.33	0.83	0.68	0.61	0.59
2010	3.20	2.39	1.65	1.04	0.57	0.42	0.32	0.18
2011	2.65	1.95	2.75	1.80	0.56	0.45	0.59	0.46
2012	0.39	1.32	0.23	1.27	0.09	0.29	0.06	0.29
2013	0.71	0.92	0.66	0.43	0.13	0.15	0.15	0.08

Table 13. Annual length indices (mean, 2 standard errors; cm) of winter flounder in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Length (cm)	
	Mean	2 Standard errors
2003	26.41	7.55
2004	25.19	8.04
2005	25.49	8.25
2006	25.45	8.08
2007	25.19	7.87
2008	25.57	8.21
2009	23.86	9.75
2010	23.46	8.65
2011	24.36	8.77
2012	25.12	7.06
2013	23.05	9.66

Table 14. Annual indices (mean, 2 standard errors) for yellowtail flounder by numbers and weight per tow in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Number				Weight (kg)			
	Mean		2 Standard errors		Mean		2 Standard errors	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
2003	10.90	10.90	3.56	3.56	1.42	1.42	0.46	0.46
2004	9.70	9.70	4.11	4.11	1.38	1.38	0.58	0.58
2005	7.75	7.75	3.06	3.06	0.97	0.97	0.39	0.39
2006	5.61	4.74	1.85	1.60	0.68	0.58	0.24	0.20
2007	3.55	3.01	1.92	1.86	0.48	0.41	0.26	0.25
2008	5.81	3.82	2.98	1.72	0.66	0.44	0.33	0.19
2009	5.09	4.04	2.35	1.94	0.53	0.42	0.23	0.19
2010	3.51	3.25	2.13	1.78	0.38	0.35	0.22	0.19
2011	4.99	4.83	2.63	2.69	0.47	0.45	0.25	0.24
2012	4.24	3.47	2.79	2.10	0.43	0.35	0.25	0.21
2013	2.39	2.16	1.80	1.04	0.22	0.20	0.14	0.08

Table 15. Annual length indices (mean, 2 standard errors; cm) of yellowtail in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Length (cm)	
	Mean	2 Standard errors
2003	23.71	7.36
2004	23.82	6.64
2005	23.67	6.82
2006	23.99	6.20
2007	24.01	5.83
2008	22.97	5.73
2009	22.34	6.79
2010	22.77	6.00
2011	22.19	6.00
2012	21.10	5.40
2013	21.27	5.88

Table 16. Annual indices (mean, 2 standard errors) of Atlantic herring by numbers and weight per tow in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Number				Weight (kg)			
	Mean		2 Standard errors		Mean		2 Standard errors	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
2003	76.31	n/a	92.08	n/a	22.77	n/a	23.59	n/a
2004	68.21	n/a	60.46	n/a	20.71	n/a	17.00	n/a
2005	72.51	n/a	74.60	n/a	17.11	n/a	17.12	n/a
2006	93.48	n/a	123.59	n/a	17.33	n/a	22.69	n/a
2007	181.21	n/a	145.33	n/a	28.37	n/a	23.79	n/a
2008	94.43	n/a	63.46	n/a	18.88	n/a	13.36	n/a
2009	57.23	n/a	55.44	n/a	9.58	n/a	10.08	n/a
2010	114.82	n/a	99.14	n/a	13.97	n/a	12.02	n/a
2011	54.29	n/a	60.13	n/a	9.14	n/a	13.03	n/a
2012	114.28	n/a	80.71	n/a	15.75	n/a	11.56	n/a
2013	66.61	n/a	52.70	n/a	9.45	n/a	7.82	n/a

Table 17. Annual length indices (mean, 2 standard errors; cm) of Atlantic herring in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2007 to 2013.

Year	Length (cm)	
	Mean	2 Standard errors
2007	26.27	8.43
2008	26.87	6.43
2009	26.99	5.97
2010	23.75	5.24
2011	23.86	7.96
2012	25.62	5.23
2013	26.21	5.43

Table 18. Annual indices (mean, 2 standard errors) for Atlantic halibut by numbers and weight per tow in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence., 2003 to 2013

Year	Number				Weight (kg)			
	Mean		2 Standard errors		Mean		2 Standard errors	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
2003	0.11	n/a	0.08	n/a	0.54	n/a	0.80	n/a
2004	0.08	n/a	0.04	n/a	0.16	n/a	0.10	n/a
2005	0.17	n/a	0.10	n/a	0.44	n/a	0.29	n/a
2006	0.12	n/a	0.06	n/a	0.47	n/a	0.44	n/a
2007	0.08	n/a	0.05	n/a	0.30	n/a	0.24	n/a
2008	0.13	n/a	0.08	n/a	0.73	n/a	0.56	n/a
2009	0.31	n/a	0.25	n/a	0.56	n/a	0.38	n/a
2010	0.17	n/a	0.12	n/a	1.33	n/a	1.41	n/a
2011	0.17	n/a	0.09	n/a	0.63	n/a	0.41	n/a
2012	0.09	n/a	0.06	n/a	0.61	n/a	0.48	n/a
2013	0.10	n/a	0.06	n/a	0.31	n/a	0.23	n/a

Table 19. Annual indices (mean, 2 standard errors) of gaspereau by numbers and weight per tow in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Number				Weight (kg)			
	Mean		2 Standard errors		Mean		2 Standard errors	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
2003	0.43	n/a	0.38	n/a	0.07	n/a	0.06	n/a
2004	0.39	n/a	0.57	n/a	0.06	n/a	0.08	n/a
2005	0.07	n/a	0.06	n/a	0.01	n/a	0.01	n/a
2006	0.17	n/a	0.18	n/a	0.04	n/a	0.06	n/a
2007	0.15	n/a	0.14	n/a	0.02	n/a	0.01	n/a
2008	0.10	n/a	0.09	n/a	0.02	n/a	0.02	n/a
2009	12.40	n/a	23.69	n/a	1.62	n/a	3.07	n/a
2010	1.31	n/a	1.78	n/a	0.18	n/a	0.26	n/a
2011	0.37	n/a	0.56	n/a	0.15	n/a	0.16	n/a
2012	0.03	n/a	0.00	n/a	0.03	n/a	0.04	n/a
2013	0.12	n/a	0.15	n/a	0.02	n/a	0.02	n/a

Table 20. Annual indices (mean, 2 standard errors) of rainbow smelt by numbers and weight per tow in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

Year	Number				Weight (kg)			
	Mean		2 Standard errors		Mean		2 Standard errors	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
2003	2.21	n/a	2.04	n/a	0.10	n/a	0.09	n/a
2004	0.93	n/a	1.30	n/a	0.03	n/a	0.04	n/a
2005	4.01	n/a	3.72	n/a	0.15	n/a	0.13	n/a
2006	1.52	n/a	1.34	n/a	0.06	n/a	0.05	n/a
2007	3.54	n/a	2.81	n/a	0.16	n/a	0.13	n/a
2008	2.63	n/a	3.69	n/a	0.09	n/a	0.12	n/a
2009	6.45	n/a	4.73	n/a	0.25	n/a	0.18	n/a
2010	1.58	n/a	1.59	n/a	0.07	n/a	0.06	n/a
2011	1.67	n/a	2.59	n/a	0.05	n/a	0.08	n/a
2012	0.19	n/a	0.16	n/a	0.01	n/a	< 0.01	n/a
2013	1.35	n/a	1.52	n/a	0.03	n/a	0.04	n/a

FIGURES

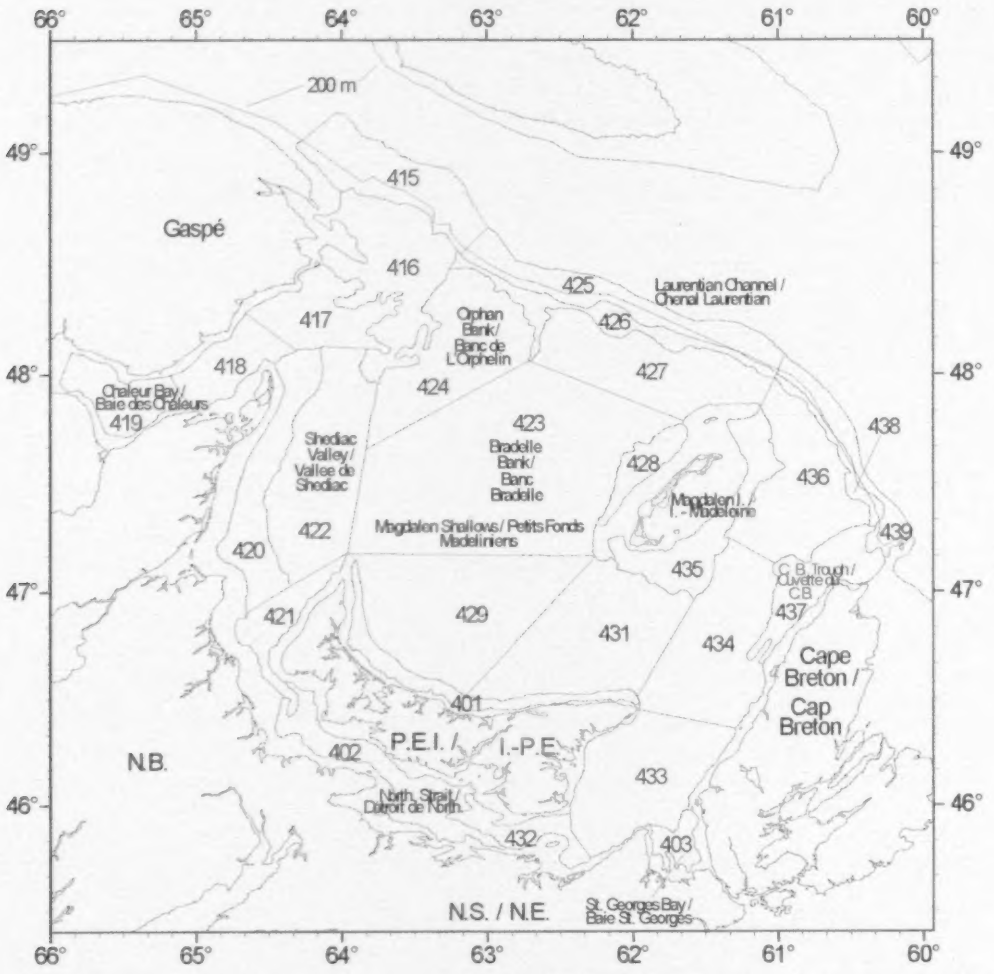

Figure 1. Stratification scheme used in the southern Gulf of St. Lawrence groundfish survey. Strata 401-403, 417-424 and 427-436 correspond to depths less than 50 fathoms, strata 416, 426, 437 and 438 lie in depths between 50 and 100 fathoms, and strata 415, 425 and 439 lie deeper than 100 fathoms.

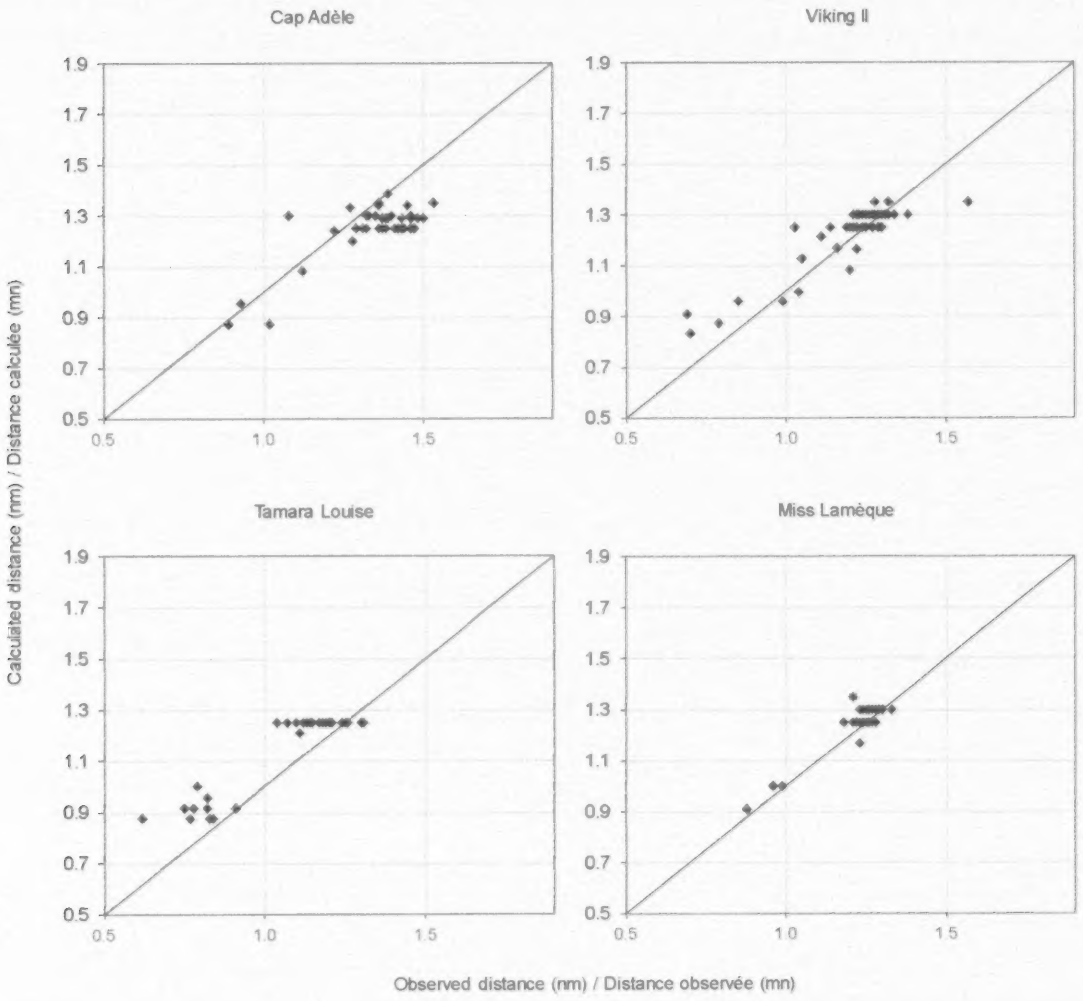

Figure 2a. Comparison of calculated versus observed tow distance (in nautical miles) by vessel for 2012. Calculated tow distances were obtained by multiplying the vessel speed and tow duration whereas observed values were derived from start and end coordinates as reported by GPS.

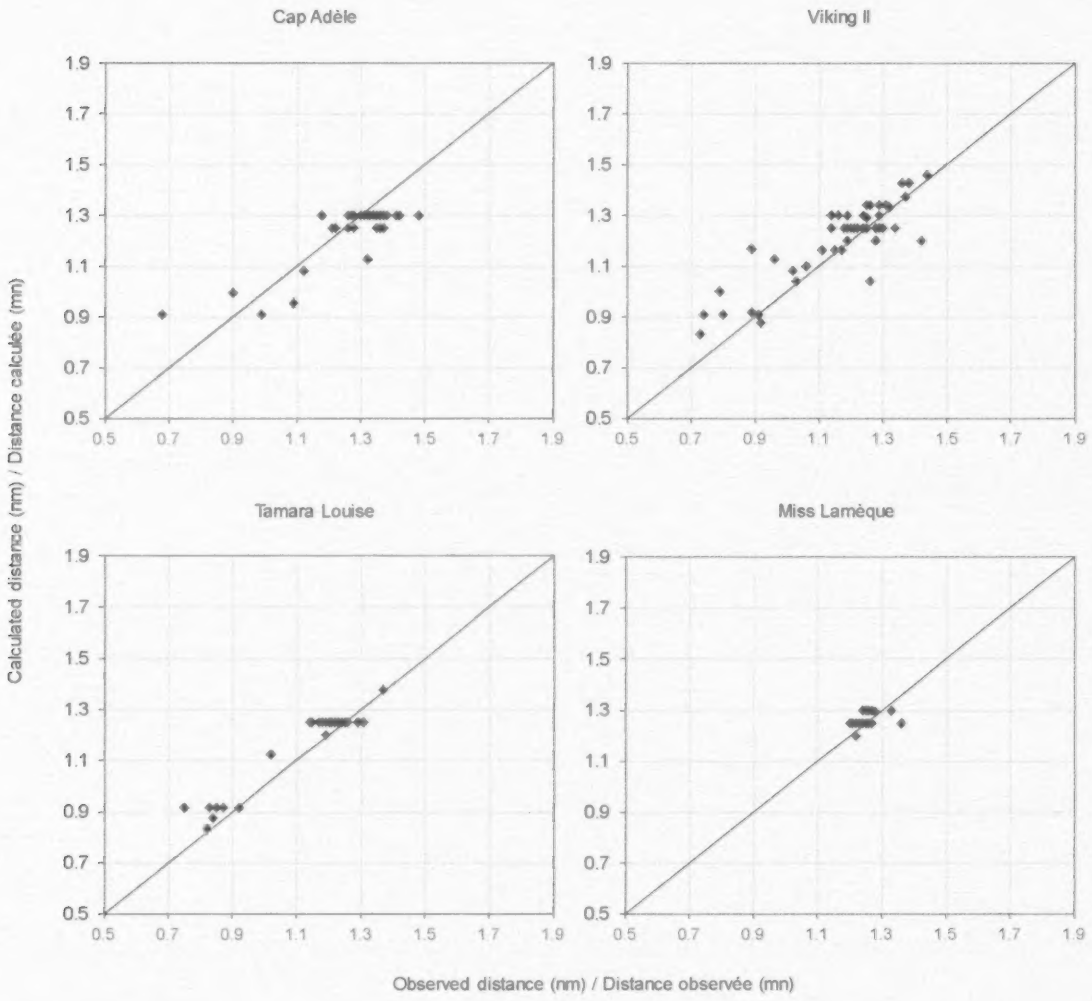

Figure 2b. Comparison of calculated versus observed tow distance (in nautical miles) by vessel for 2013. Calculated tow distances were obtained by multiplying the vessel speed and tow duration whereas observed values were derived from start and end coordinates as reported by GPS.

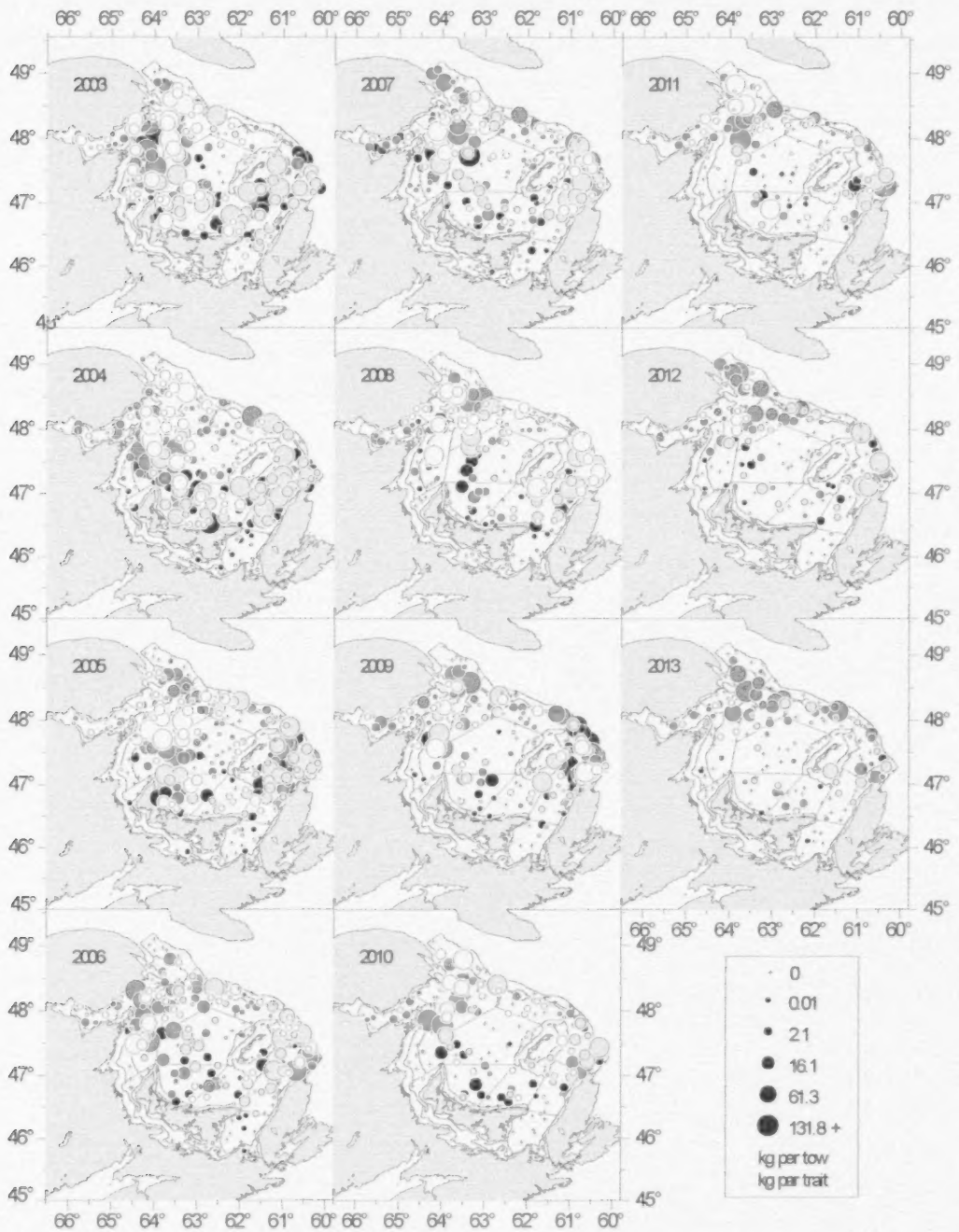

Figure 3. Atlantic cod catch indices (kilograms per standard tow) for each sentinel survey bottom-trawl set, 2003 to 2013. Each participating region is coded as follows: Prince Edward Island as black, Gaspe as dark grey, Magdalen Island as light grey and New Brunswick as white.

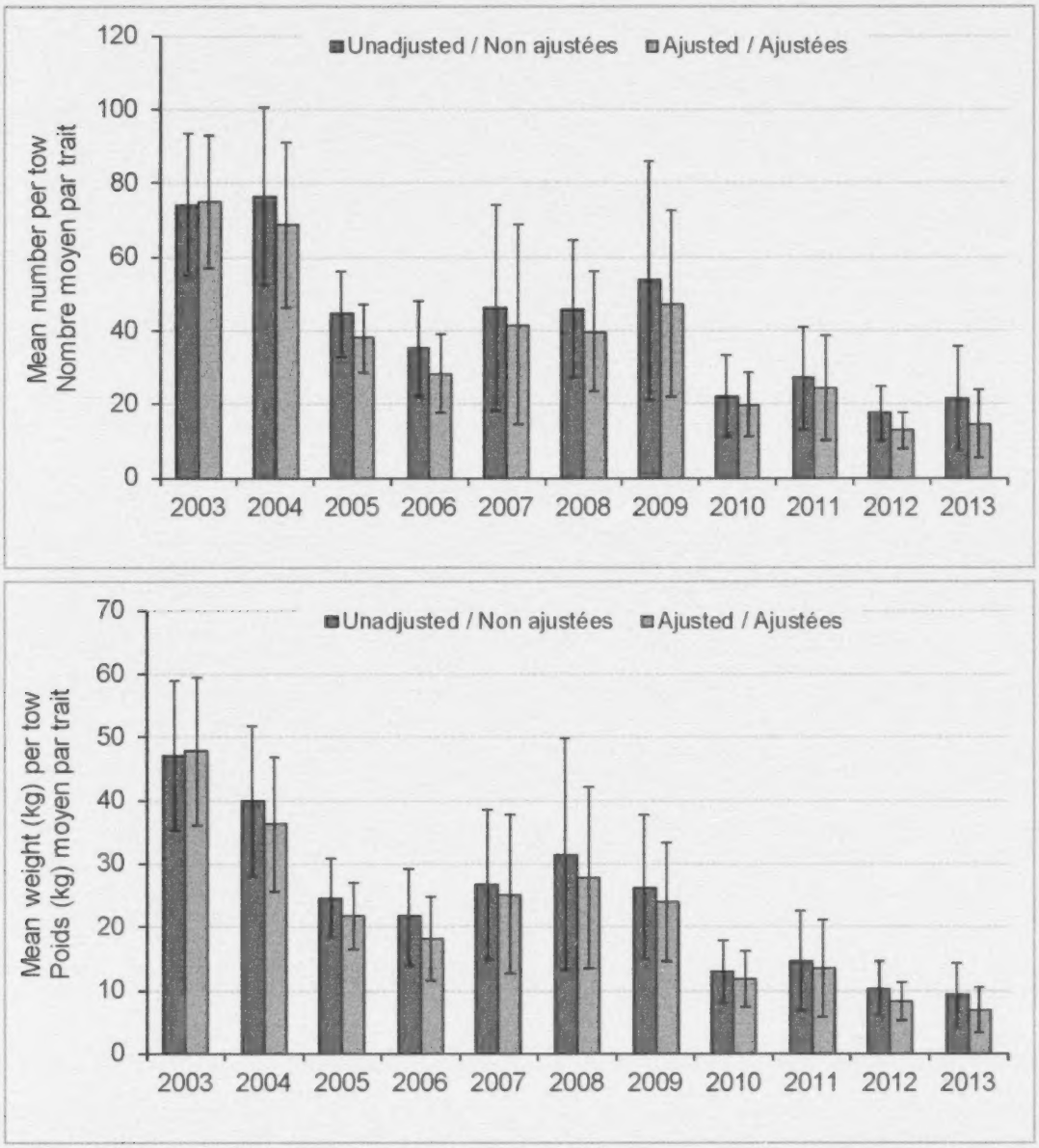

Figure 4. Mean annual indices in numbers (top) and weight (bottom) per tow of Atlantic cod in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013. Adjusted values for vessel efficiency are represented by red bars, and unadjusted ones are represented by blue bars. Vertical lines denote approximate 95% confidence limits (± 2 standard errors).

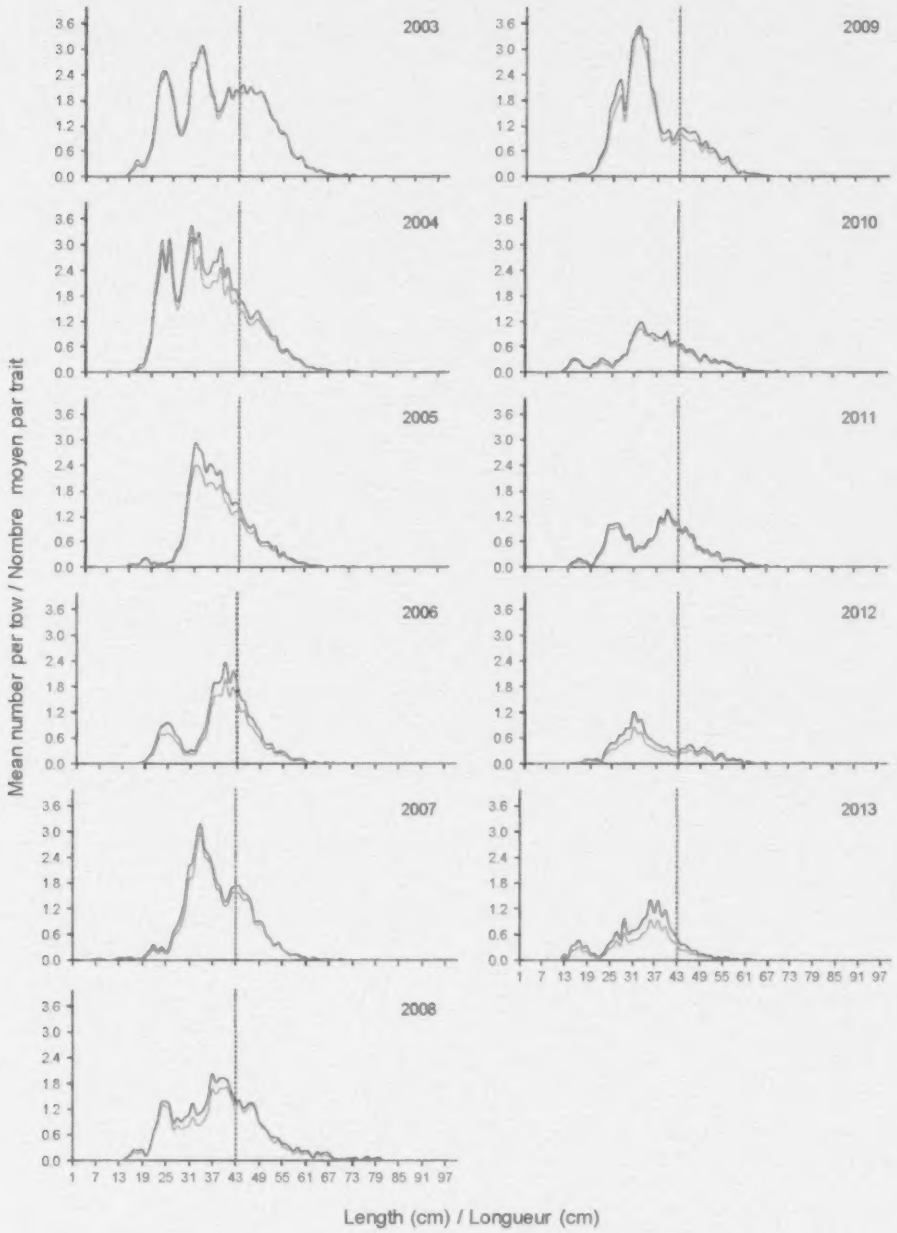

Figure 5. Annual overall cod length frequency distributions (expressed as mean number per tow) for the sentinel bottom-trawl surveys, 2003 to 2013. Adjusted values for vessel efficiency are represented by red lines, and unadjusted ones are represented by blue lines. The vertical dashed lines indicate the location of the regulated minimum size of 43 cm for cod.

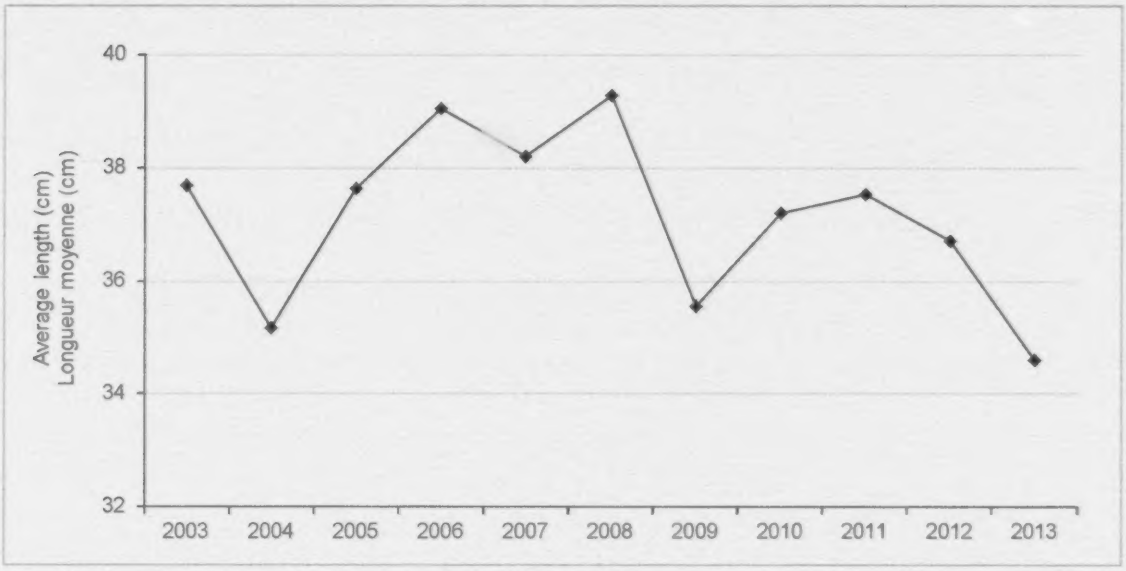

Figure 6. Annual mean lengths (cm) of Atlantic cod in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

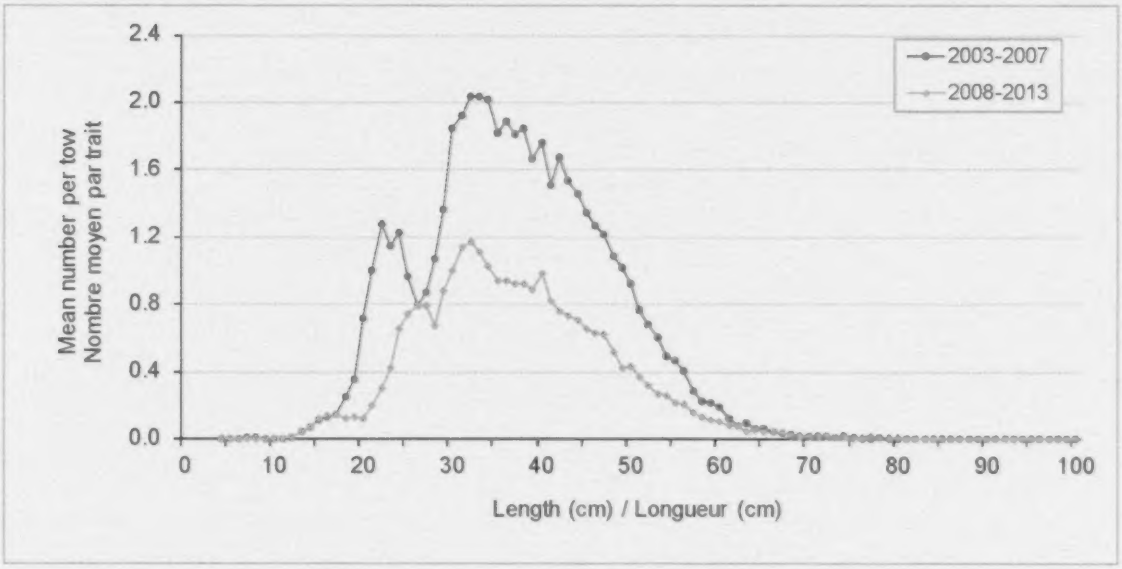

Figure 7. Average (expressed as mean number per tow) length frequency distributions of Atlantic cod from two periods (2003-2007; 2008-2013) from the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence.

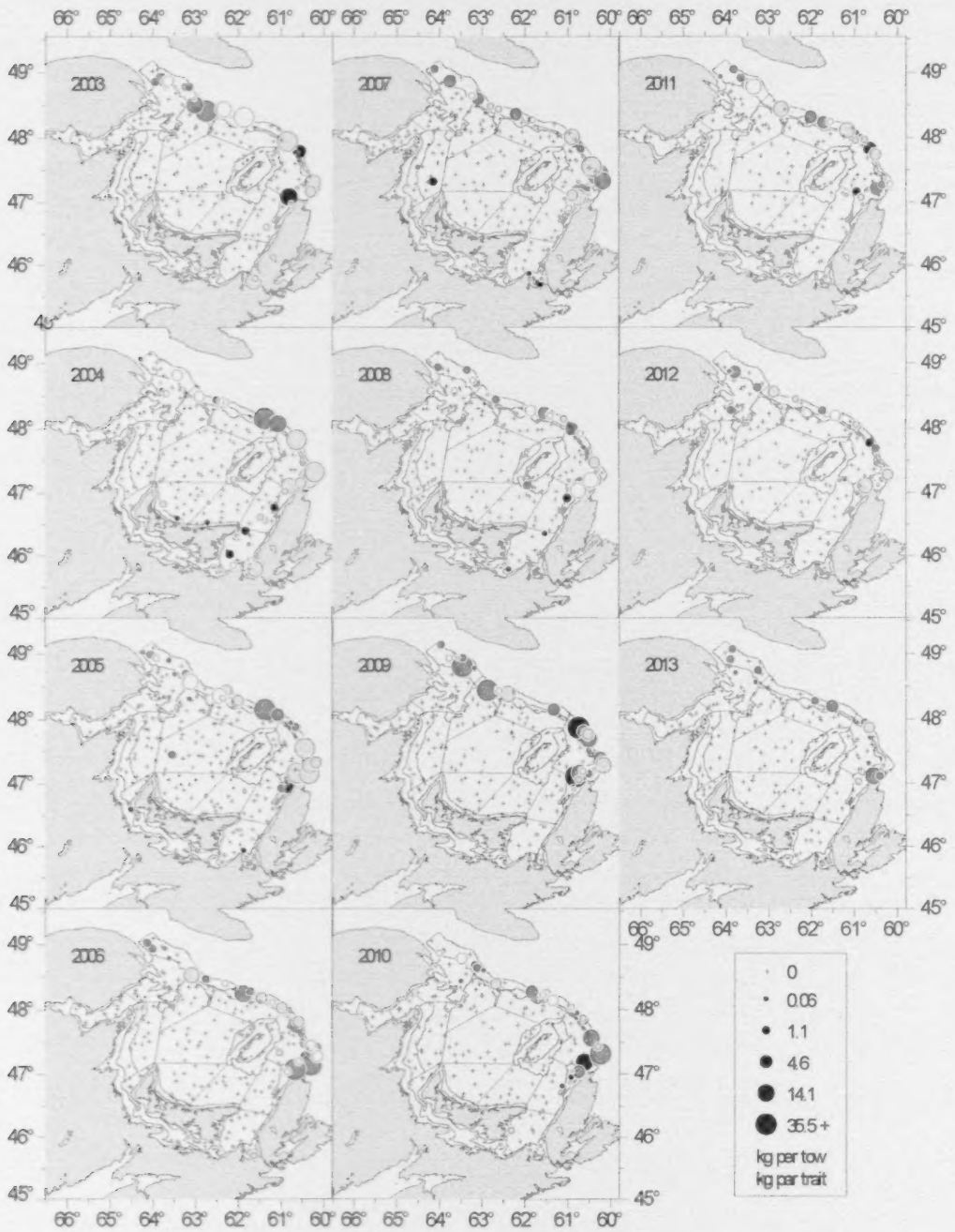

Figure 8. White hake catch indices (kilograms per standard tow) for each sentinel survey bottom-trawl set, 2003 to 2013. Each participating region is coded as follows: Prince Edward Island as black, Gaspe as dark grey, Magdalen Island as light grey and New Brunswick as white.

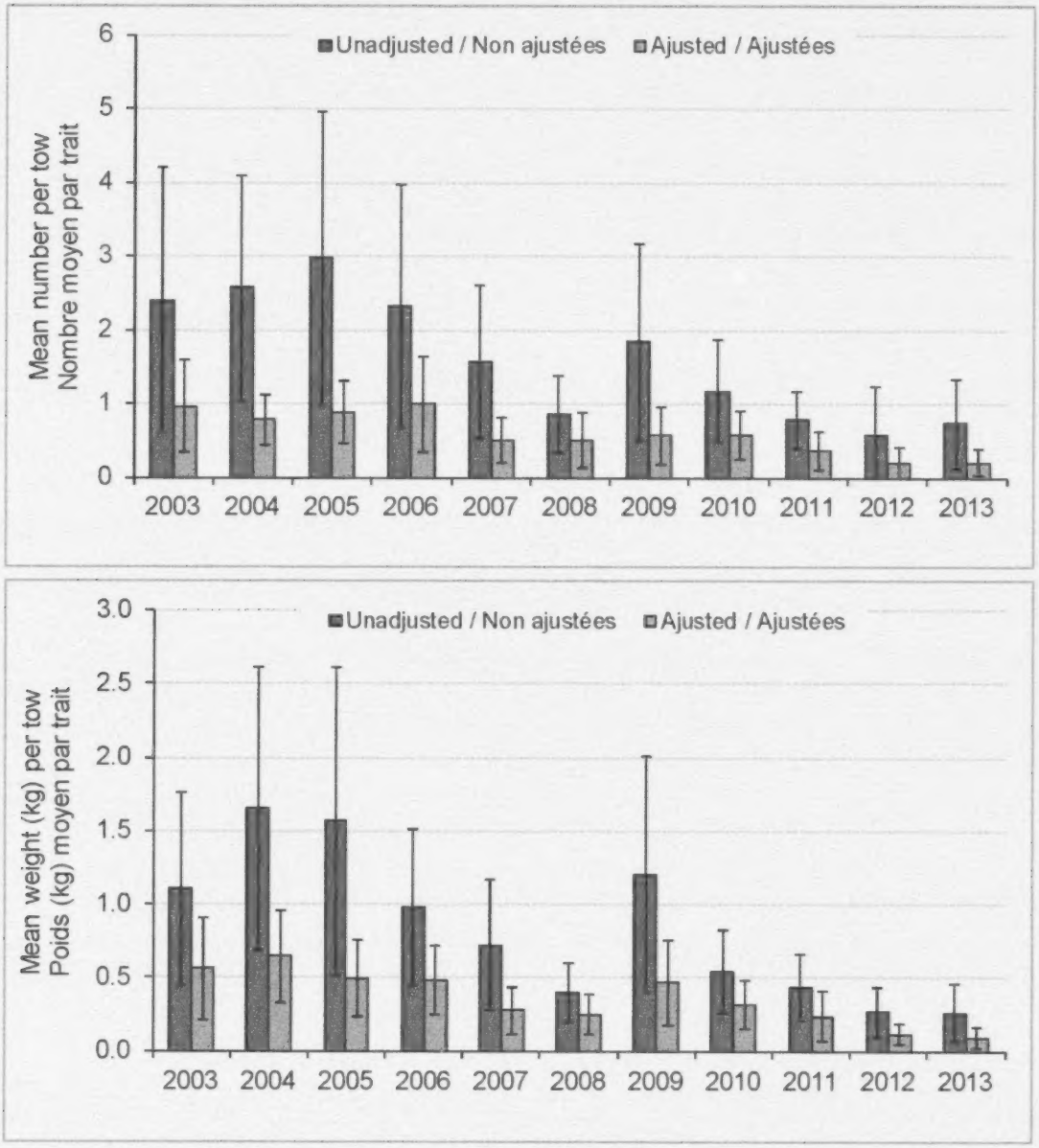

Figure 9. Mean annual indices in numbers (top) and weight (bottom) per tow of white hake in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013. Adjusted values for vessel efficiency are represented by red bars, and unadjusted ones are represented by blue bars. Vertical lines denote approximate 95% confidence limits (± 2 standard errors).

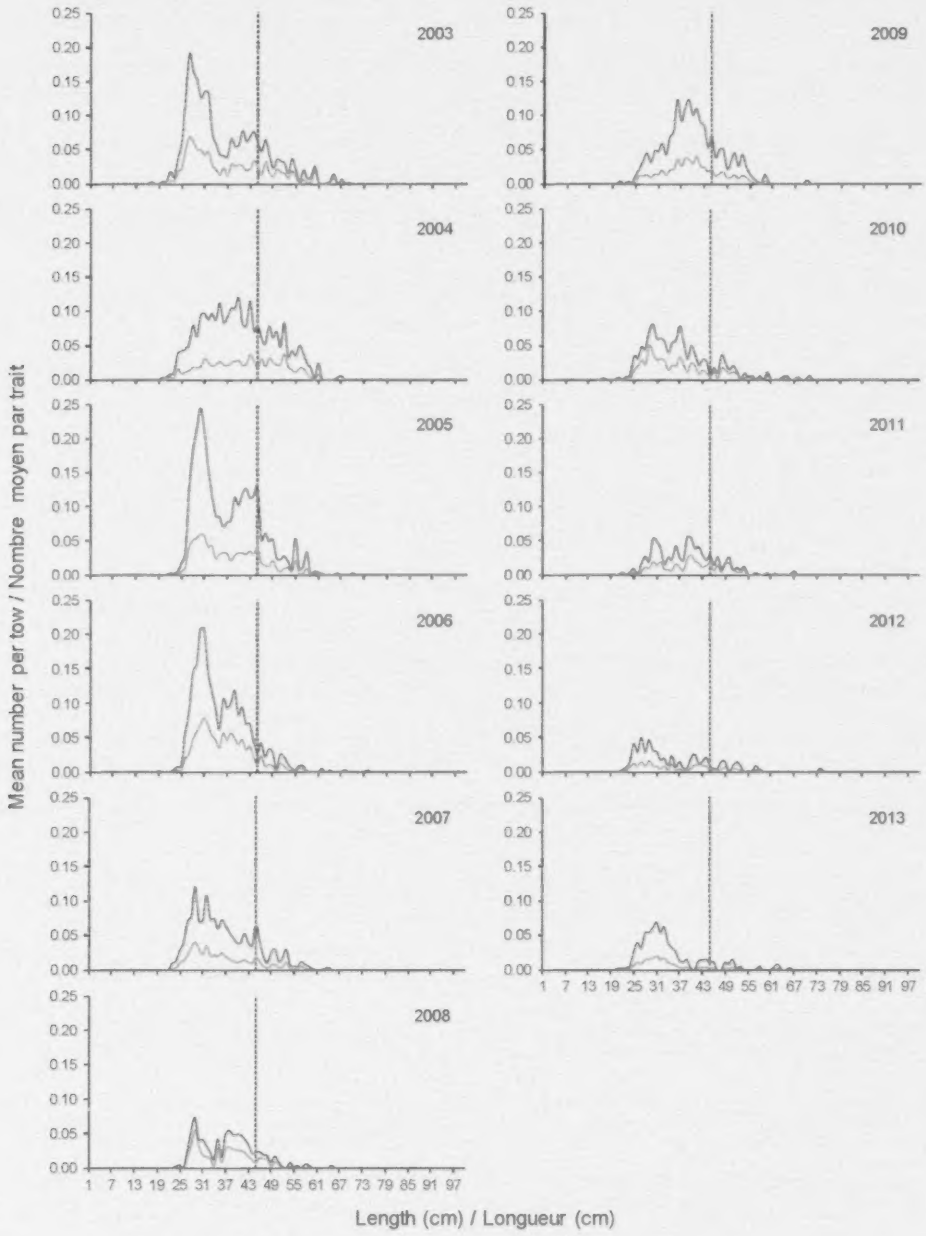

Figure 10. Annual overall white hake length frequency distributions (expressed as mean number per tow) for the sentinel bottom-trawl surveys, 2003 to 2013. Adjusted values for vessel efficiency are represented by red lines, and unadjusted ones are represented by blue lines. The vertical dashed lines indicate the regulated minimum size of 45 cm for white hake.

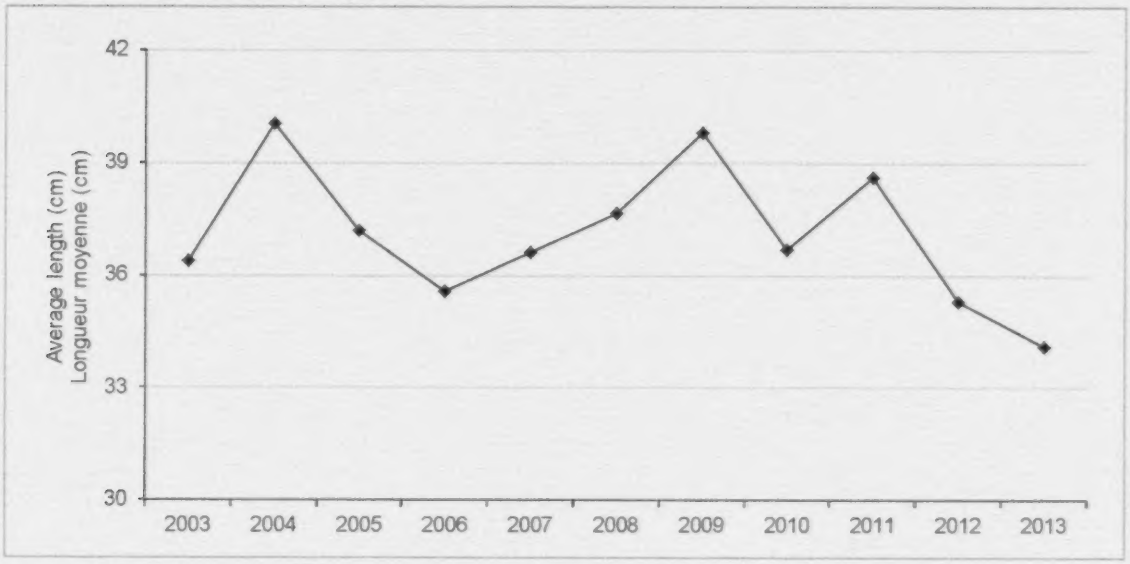

Figure 11. Annual mean lengths (cm) of white hake in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

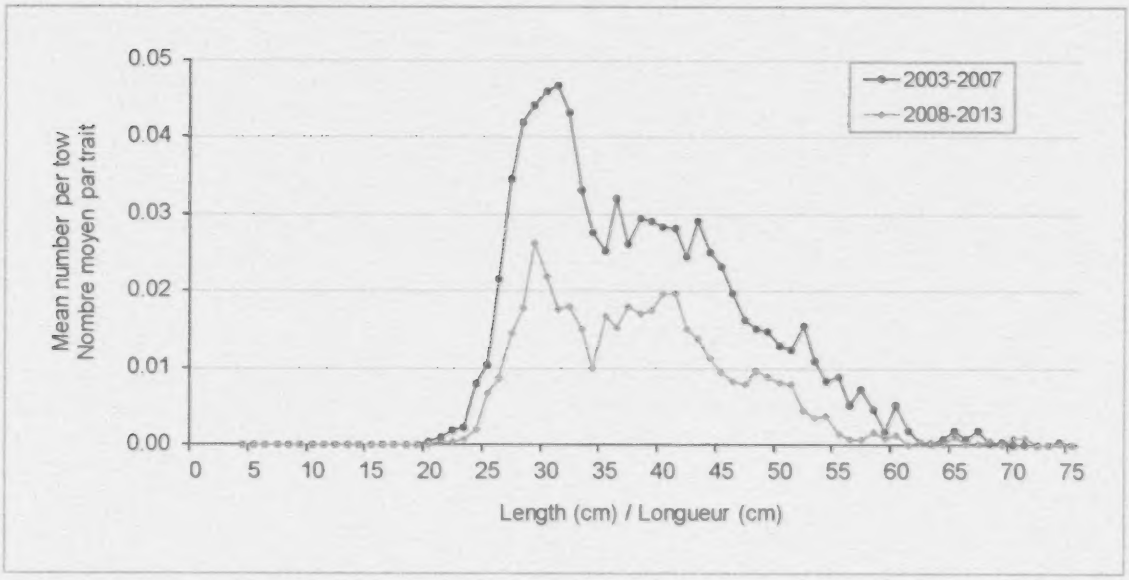

Figure 12. Average (expressed as mean number per tow) length frequency distributions of white hake for two periods (2003-2007; 2008-2013) from the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence.

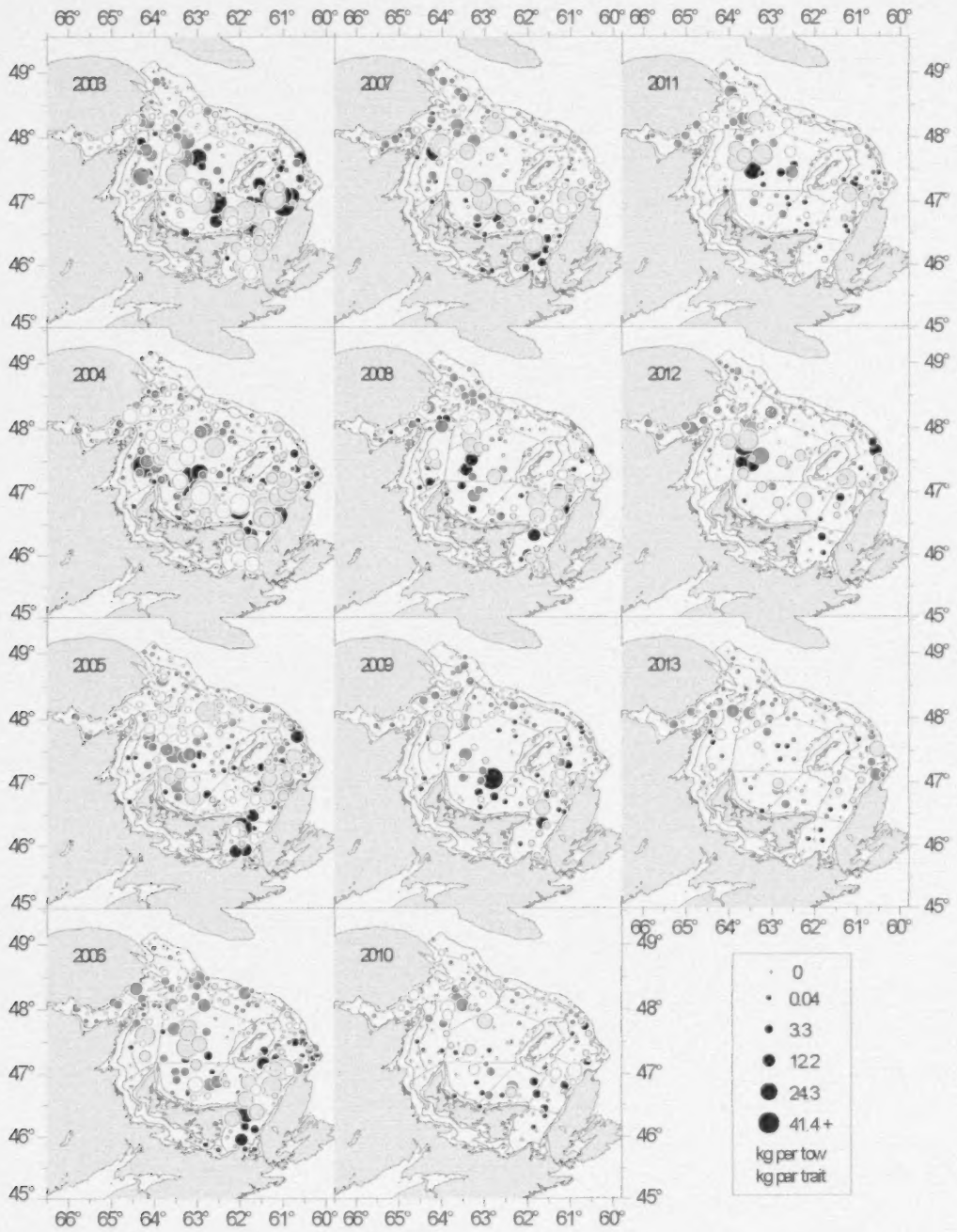

Figure 13. American Plaice catch indices (kilograms per standard tow) for each sentinel survey bottom-trawl set, 2003 to 2013. Each participating region is coded as follows: Prince Edward Island as black, Gaspe as dark grey, Magdalen Island as light grey and New Brunswick as white.

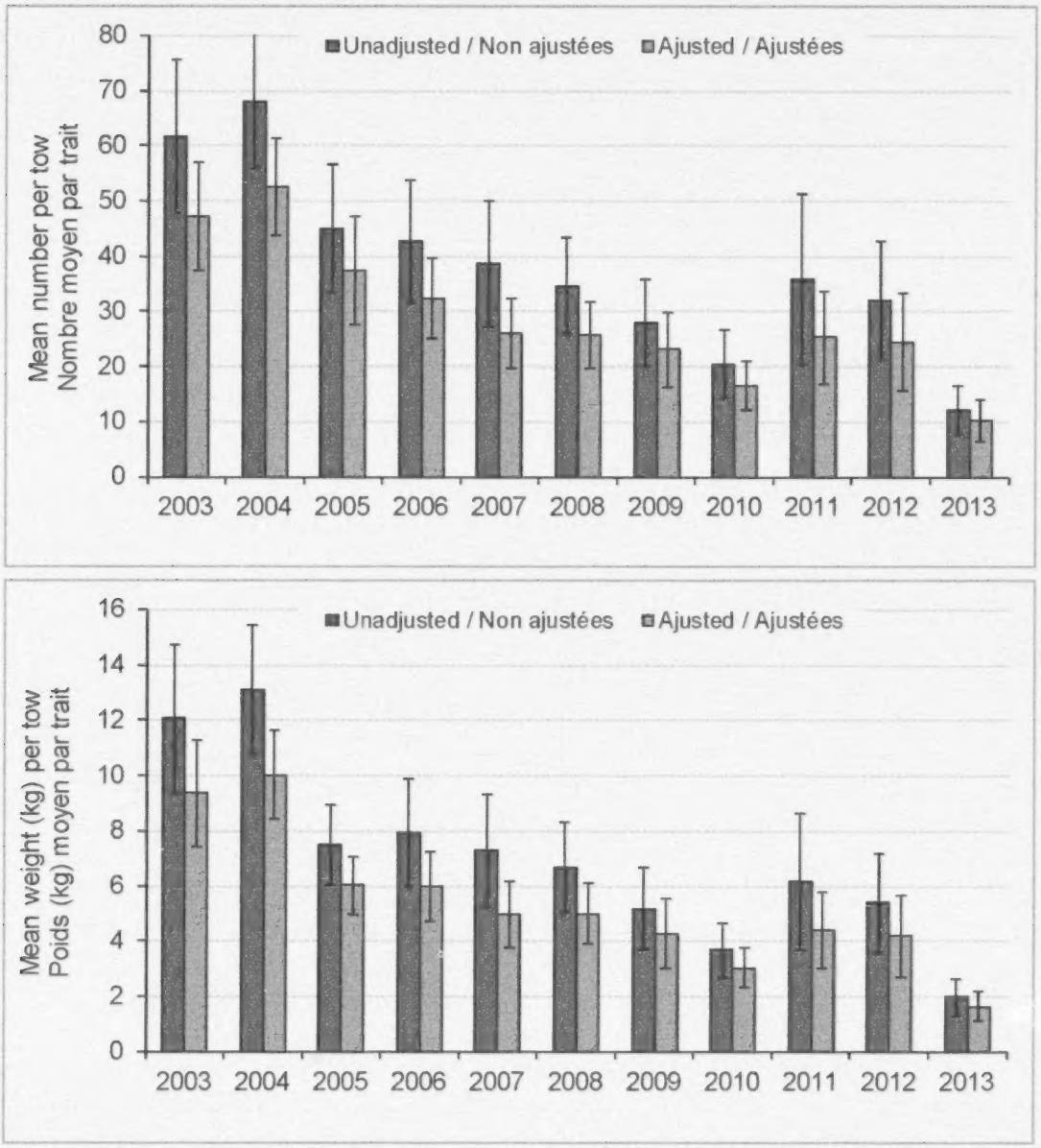

Figure 14. Mean annual indices in numbers (top) and weight (bottom) per tow of American plaice in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013. Adjusted values for vessel efficiency are represented by red bars, and unadjusted ones are represented by blue bars. Vertical lines denote approximate 95% confidence limits (± 2 standard errors).

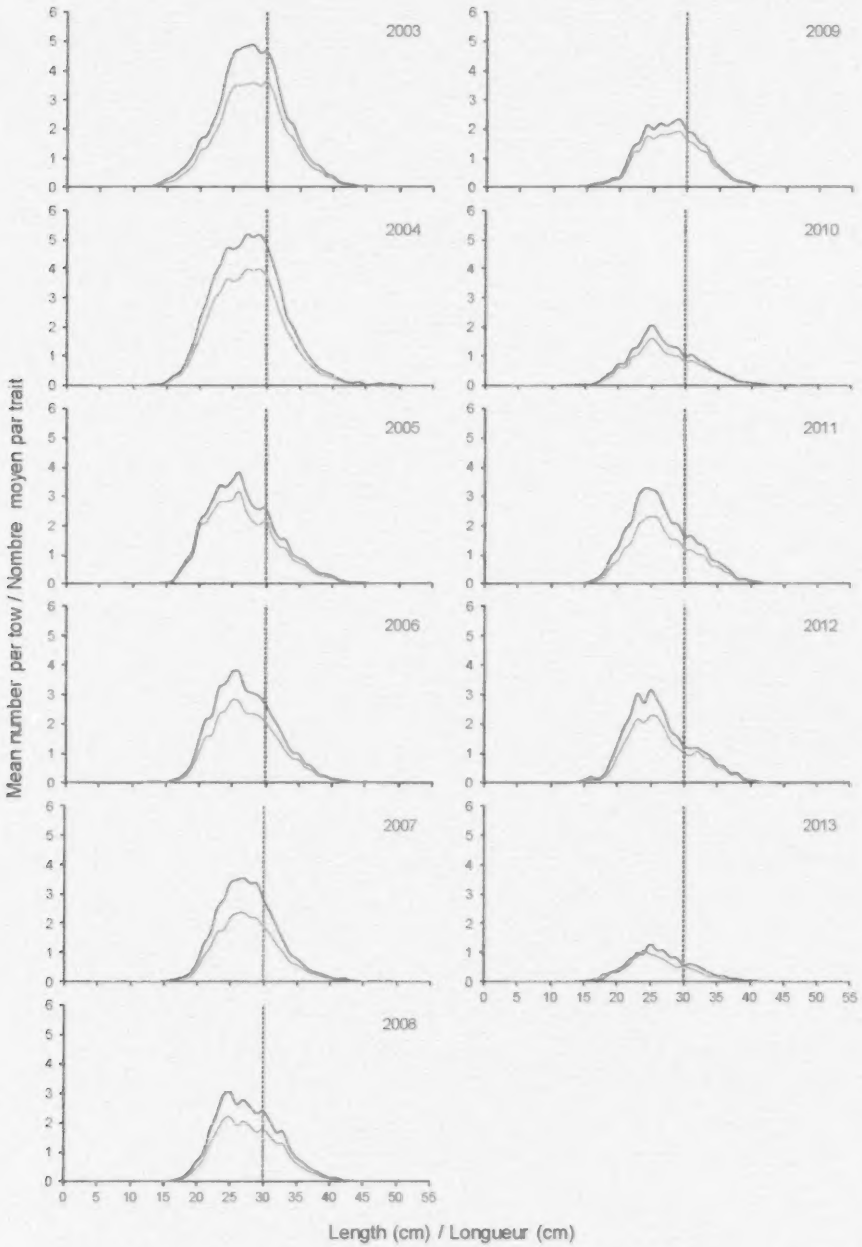

Figure 15. Annual overall American plaice length frequency distributions (expressed as mean number per tow) for the sentinel bottom-trawl surveys, 2003 to 2013. Adjusted values for vessel efficiency are represented by red lines, and unadjusted ones are represented by blue lines. The vertical dashed lines indicate the regulated minimum size of 30 cm for American plaice.

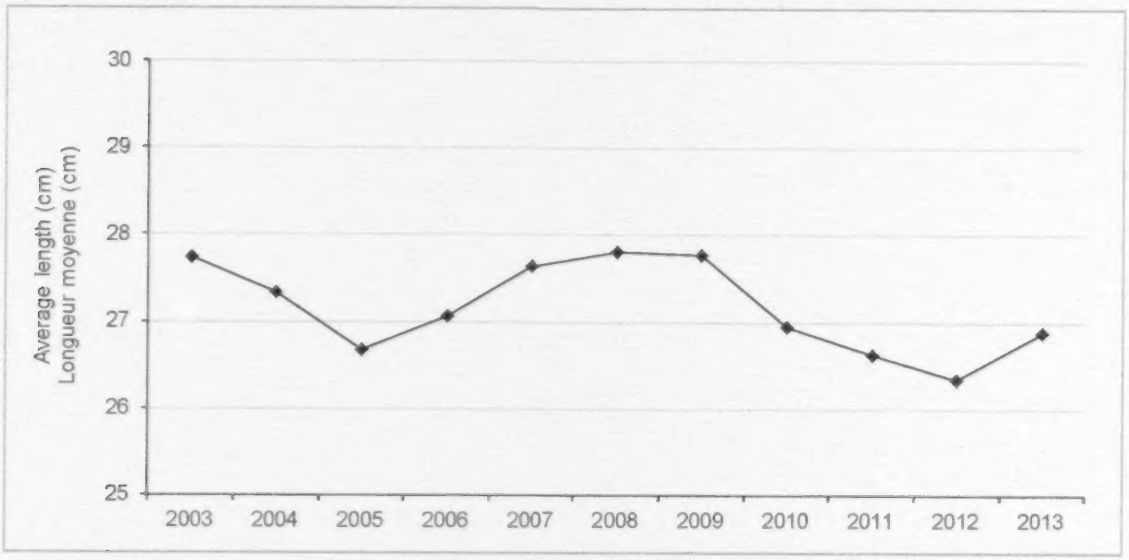

Figure 16. Annual mean length (cm) of American plaice in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

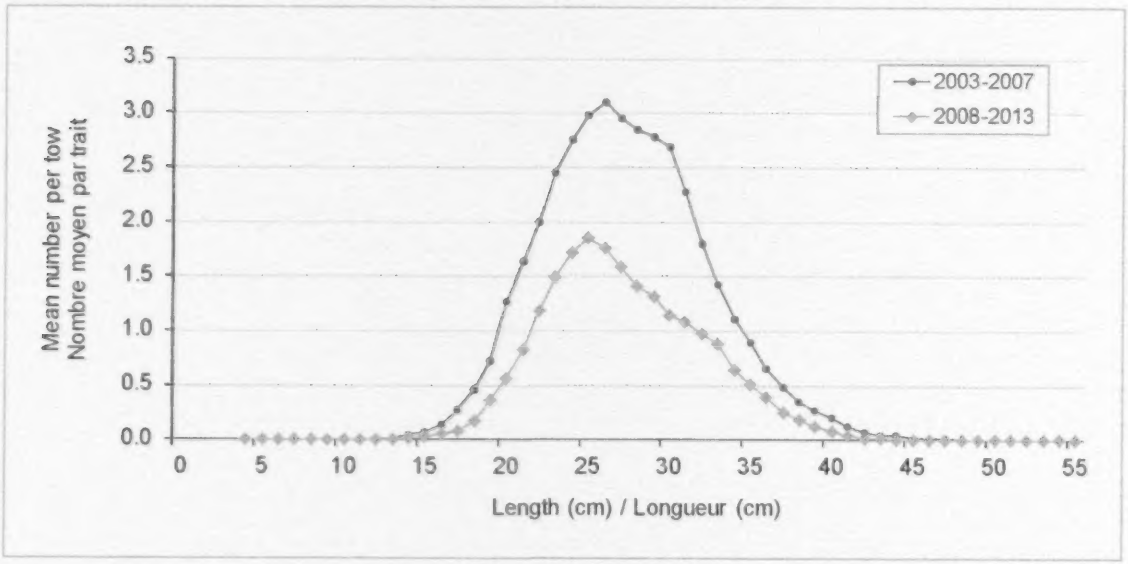

Figure 17. Average (expressed as mean number per tow) length frequency distributions of American plaice for two time periods (2003-2007; 2008-2013) from the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence.

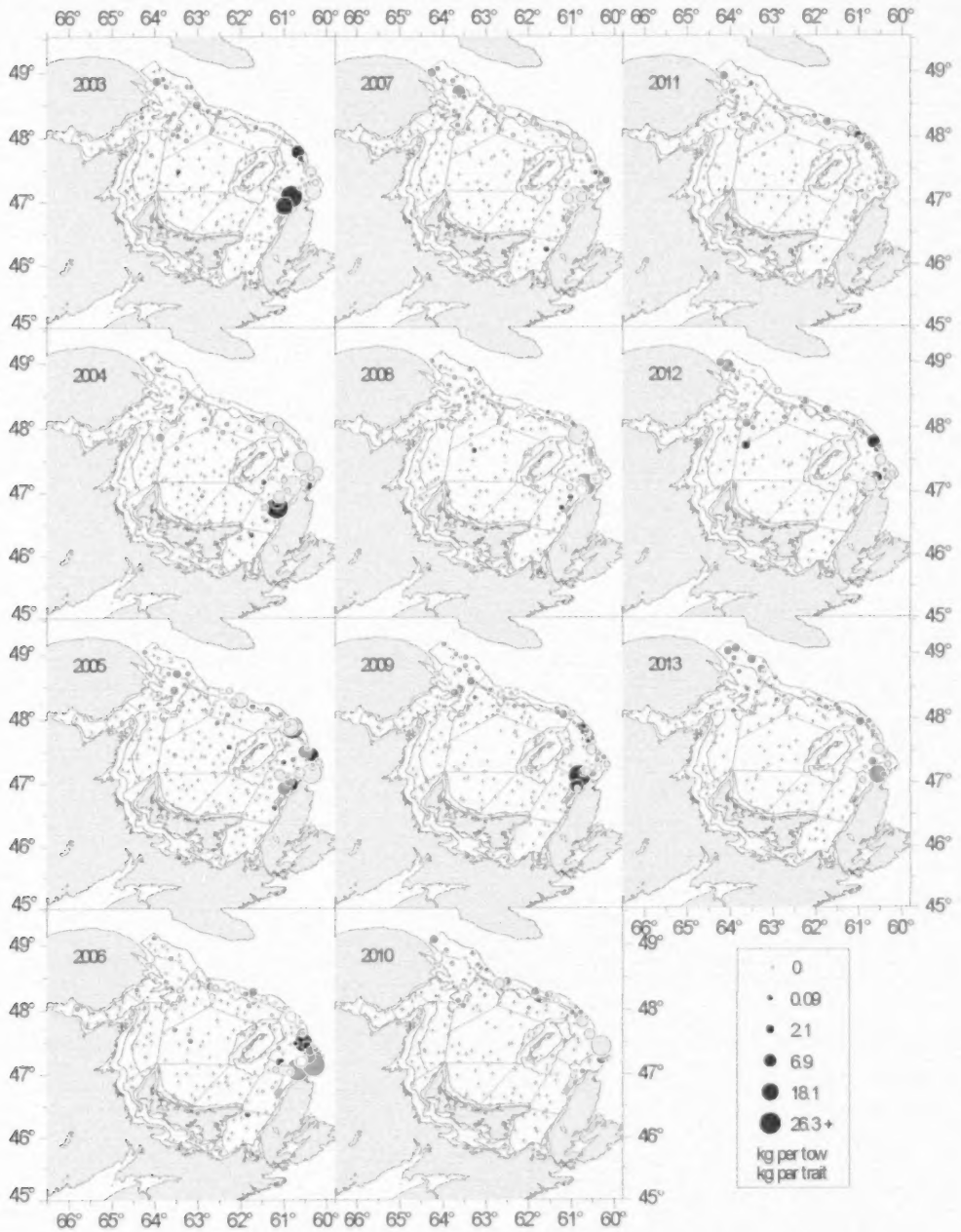

Figure 18. Witch flounder catch indices (in kilograms per standard tow) for each sentinel survey bottom-trawl set, 2003 to 2013. Each participating region is coded as follows: Prince Edward Island as black, Gaspe as dark grey, Magdalen Island as light grey and New Brunswick as white.

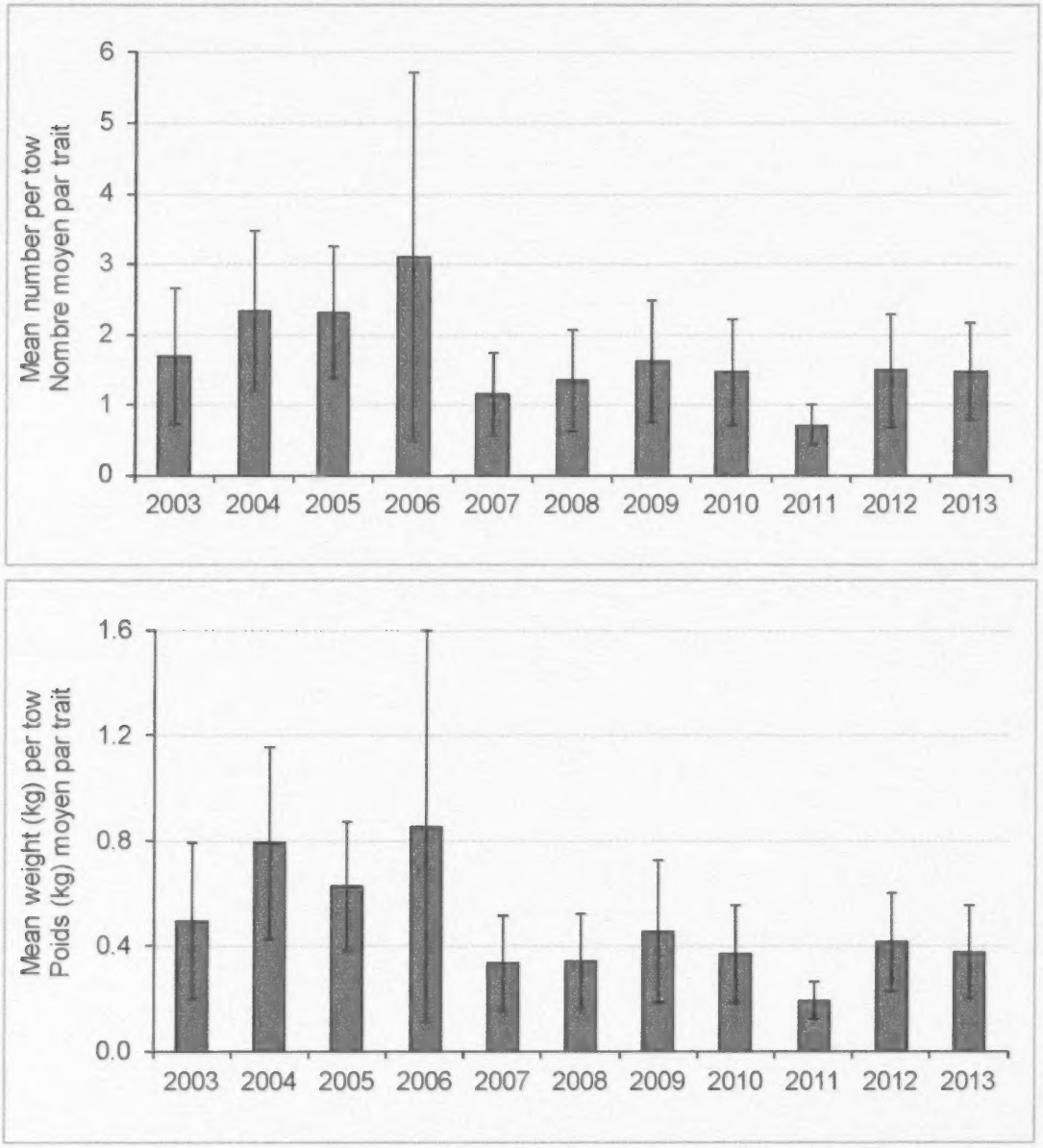

Figure 19. Mean annual indices in numbers (top) and weight (bottom) per tow of witch flounder in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013. Vertical lines denote approximate 95% confidence limits (± 2 standard errors).

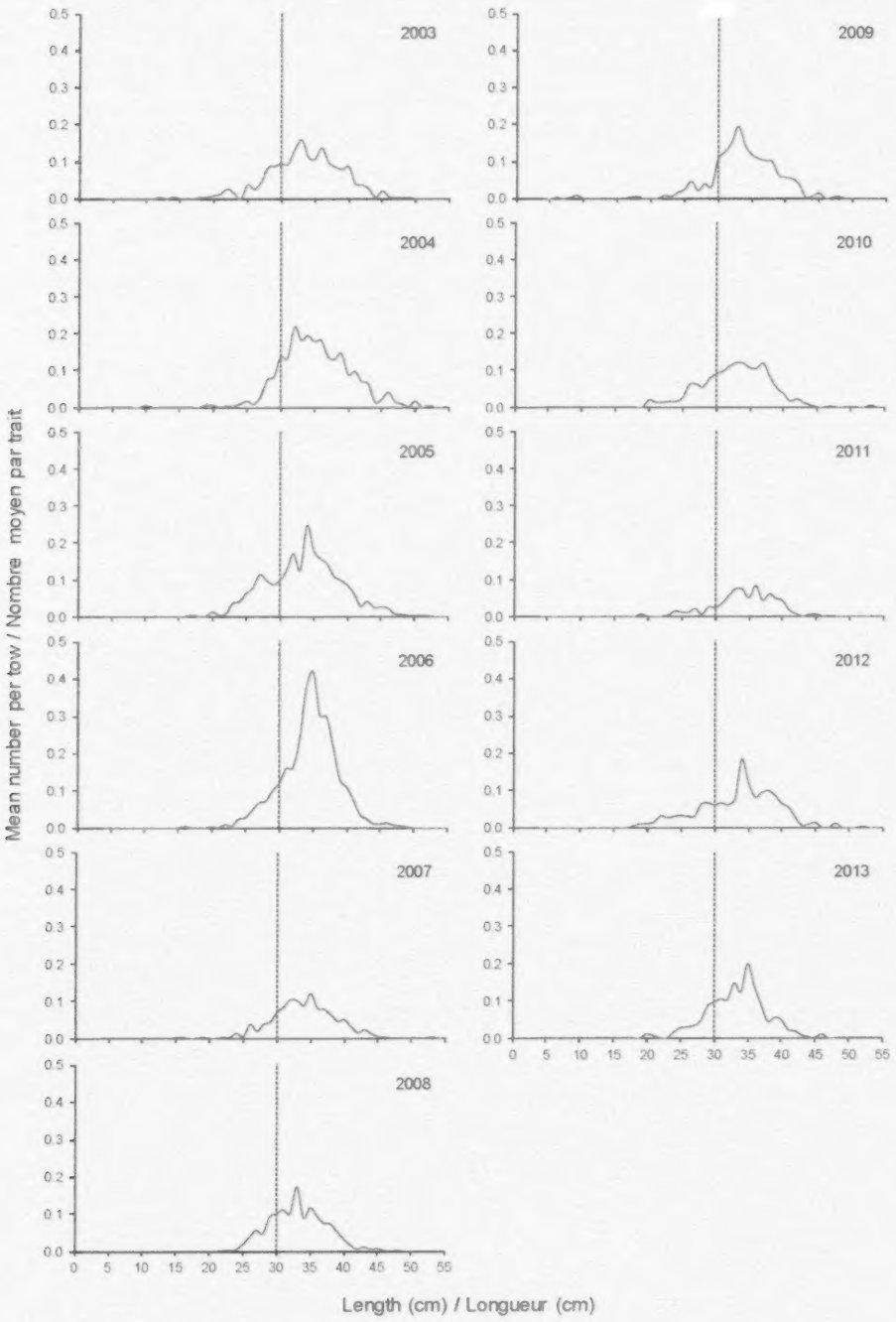

Figure 20. Annual overall witch flounder length frequency distributions (expressed as mean number per tow) for the sentinel bottom-trawl surveys, 2003 to 2013. The vertical dashed lines indicate the regulated minimum size of 30 cm for witch flounder.

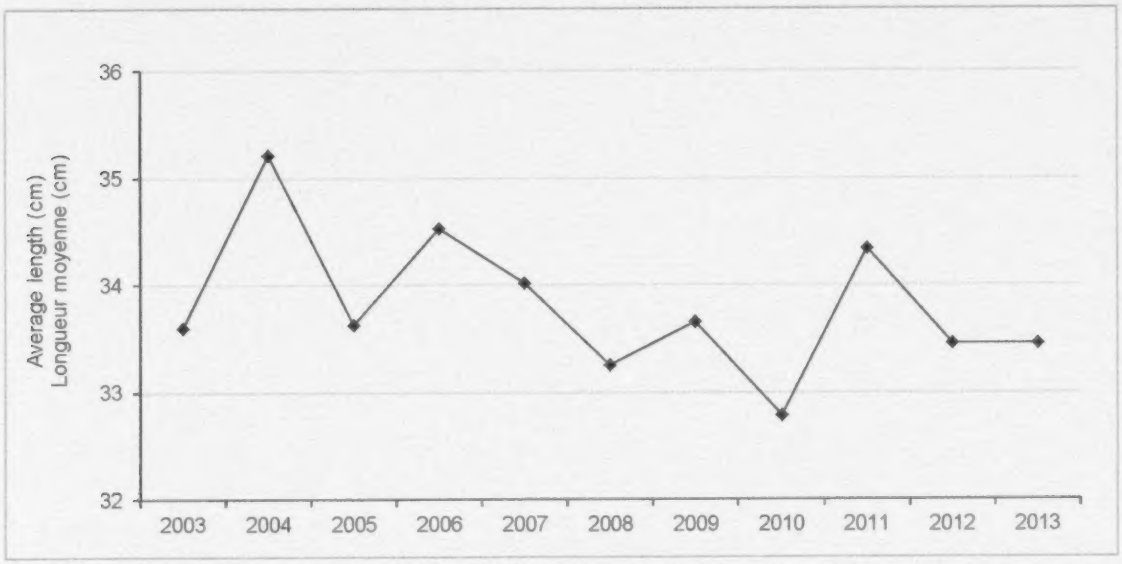

Figure 21. Annual mean length (cm) of witch flounder in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

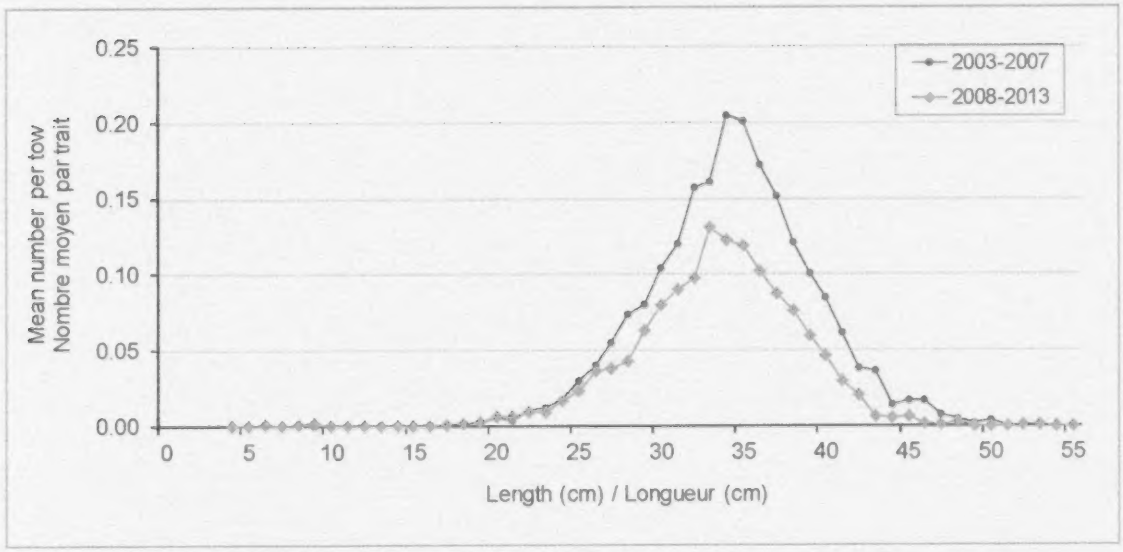

Figure 22. Average (expressed as mean number per tow) length frequency distributions of witch flounder for two periods (2003-2007; 2008-2013) from the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence.

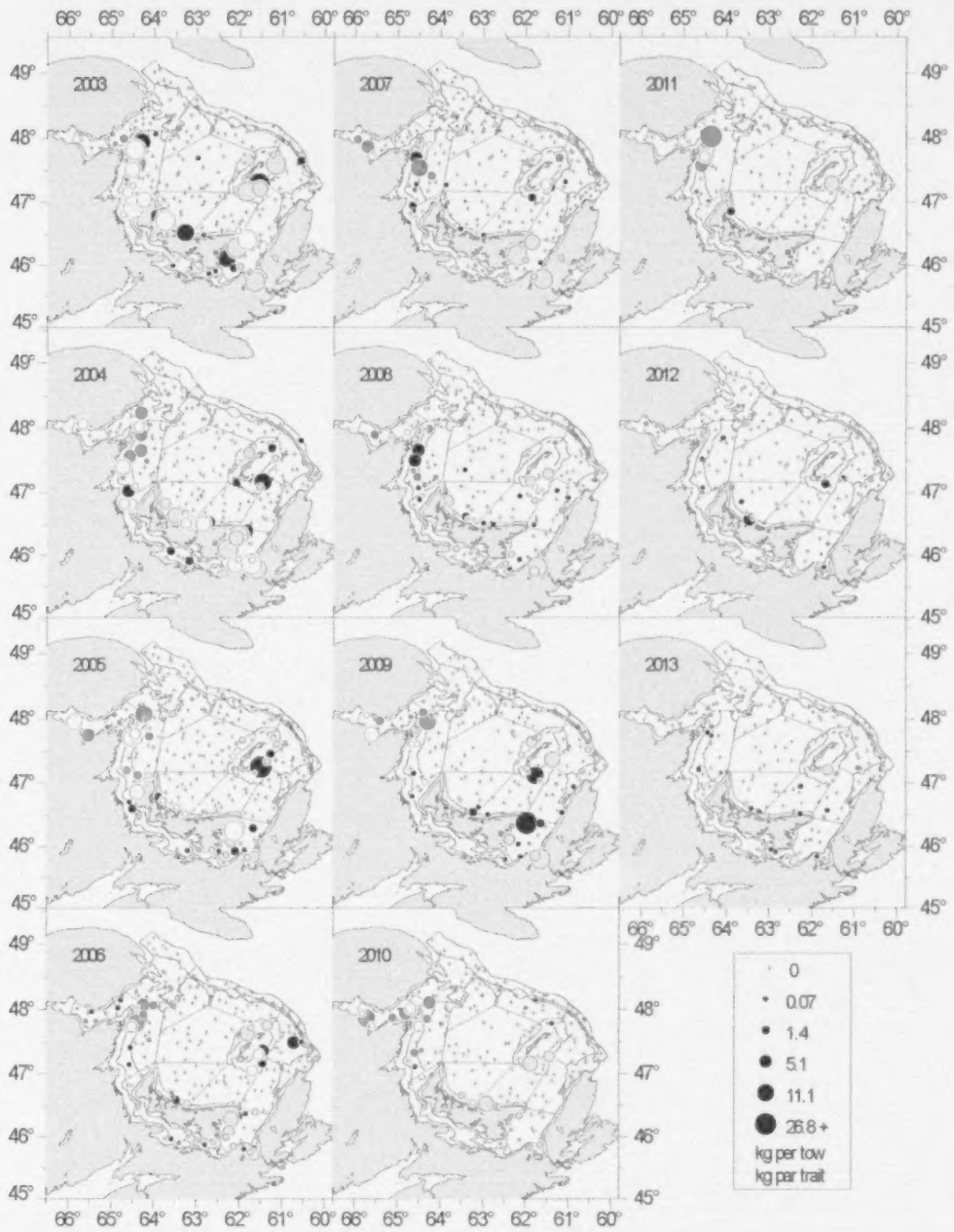

Figure 23. Winter flounder catch indices (kilograms per standard tow) for each sentinel survey bottom-trawl set, 2003 to 2013. Each participating region is coded as follows: Prince Edward Island as black, Gaspe as dark grey, Magdalen Island as light grey and New Brunswick as white.

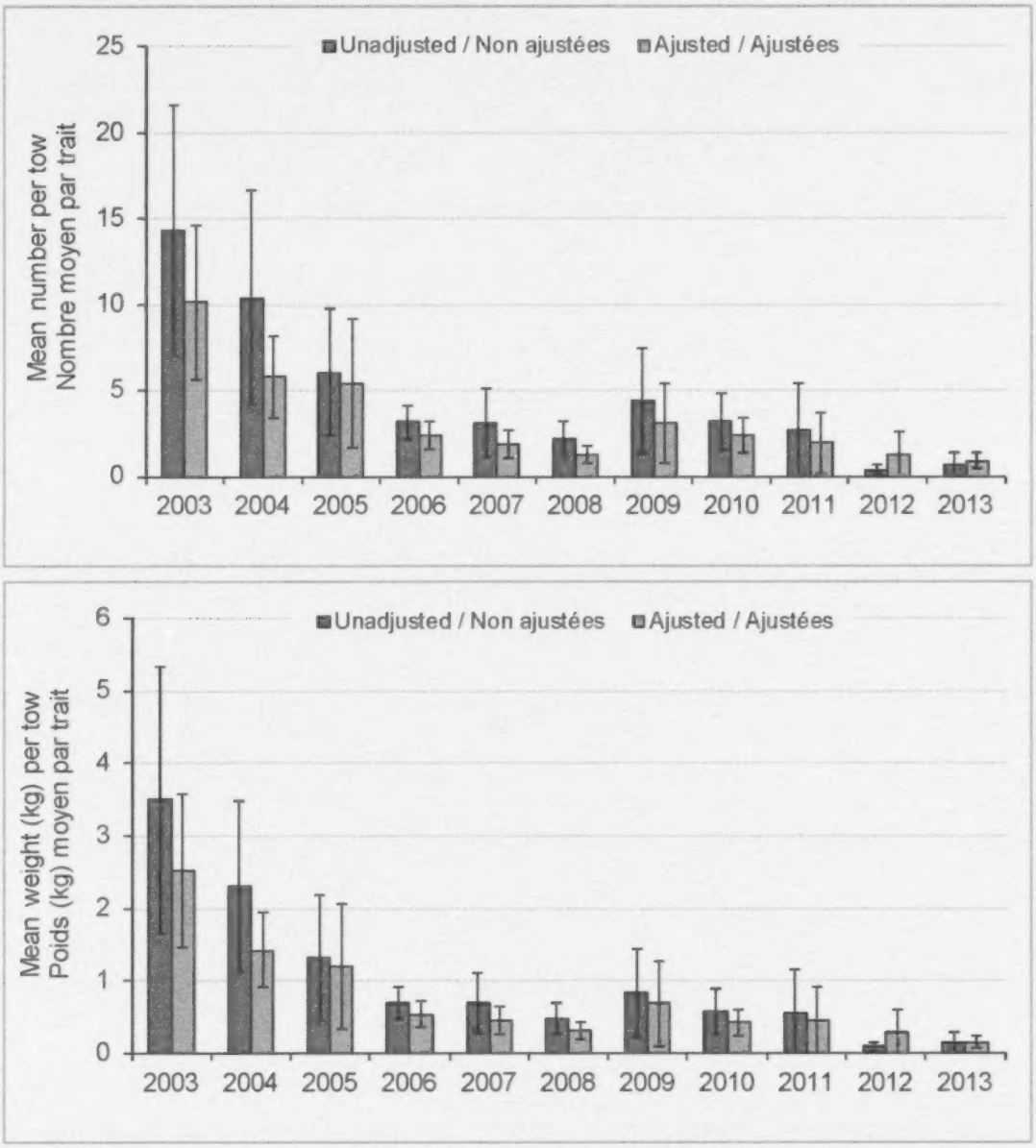

Figure 24. Mean annual indices as numbers (top) and weight (bottom) per tow of winter flounder in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013. Adjusted values for vessel efficiency are represented by red bars, and unadjusted ones are represented by blue bars. Vertical lines denote approximate 95% confidence limits (± 2 standard errors).

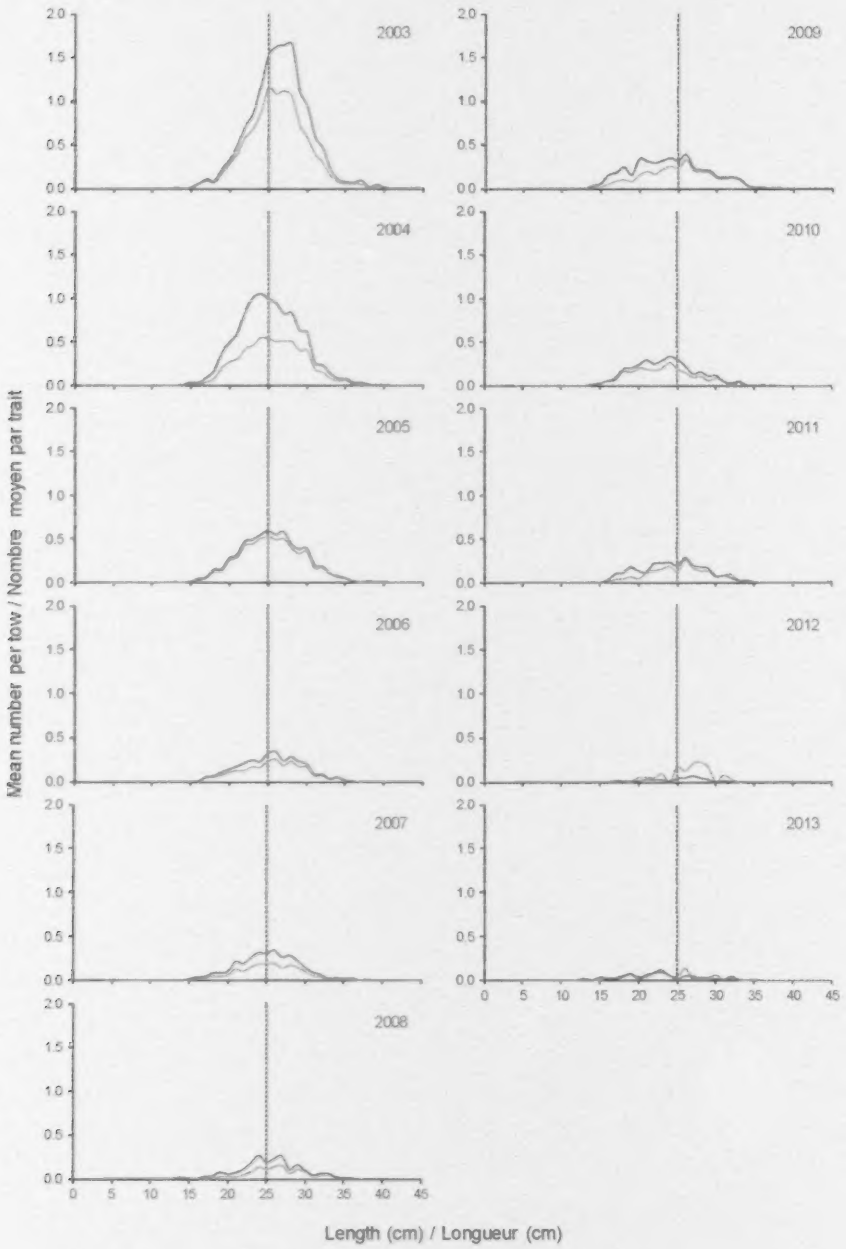

Figure 25. Annual overall winter flounder length frequency distributions (expressed as mean number per tow) for the sentinel bottom-trawl surveys, 2003 to 2013. Adjusted values for vessel efficiency are represented by red lines, and unadjusted ones are represented by blue lines. The vertical dashed lines indicate the regulated minimum size of 25 cm for winter flounder.

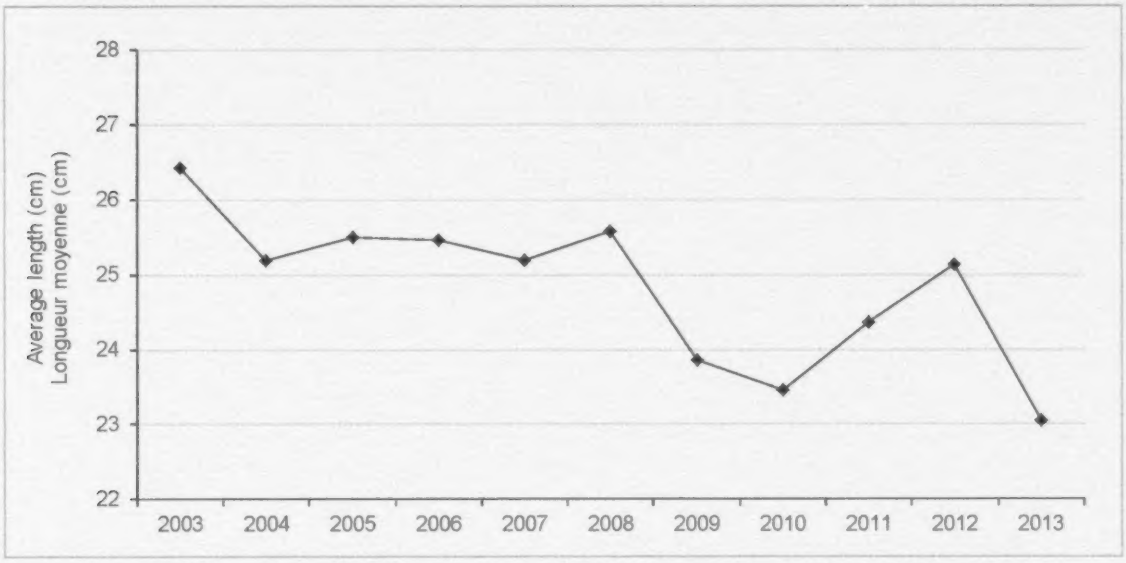

Figure 26. Annual mean length (cm) of winter flounder in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

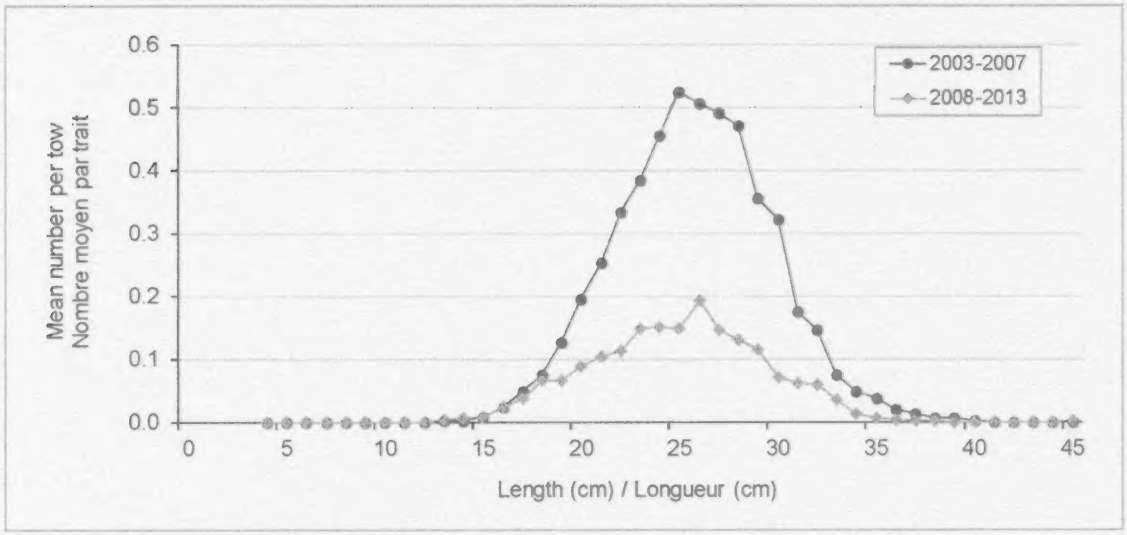

Figure 27. Average (expressed as mean number per tow) length frequency distributions of winter flounder for two periods (2003-2007; 2008-2013) from the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence.

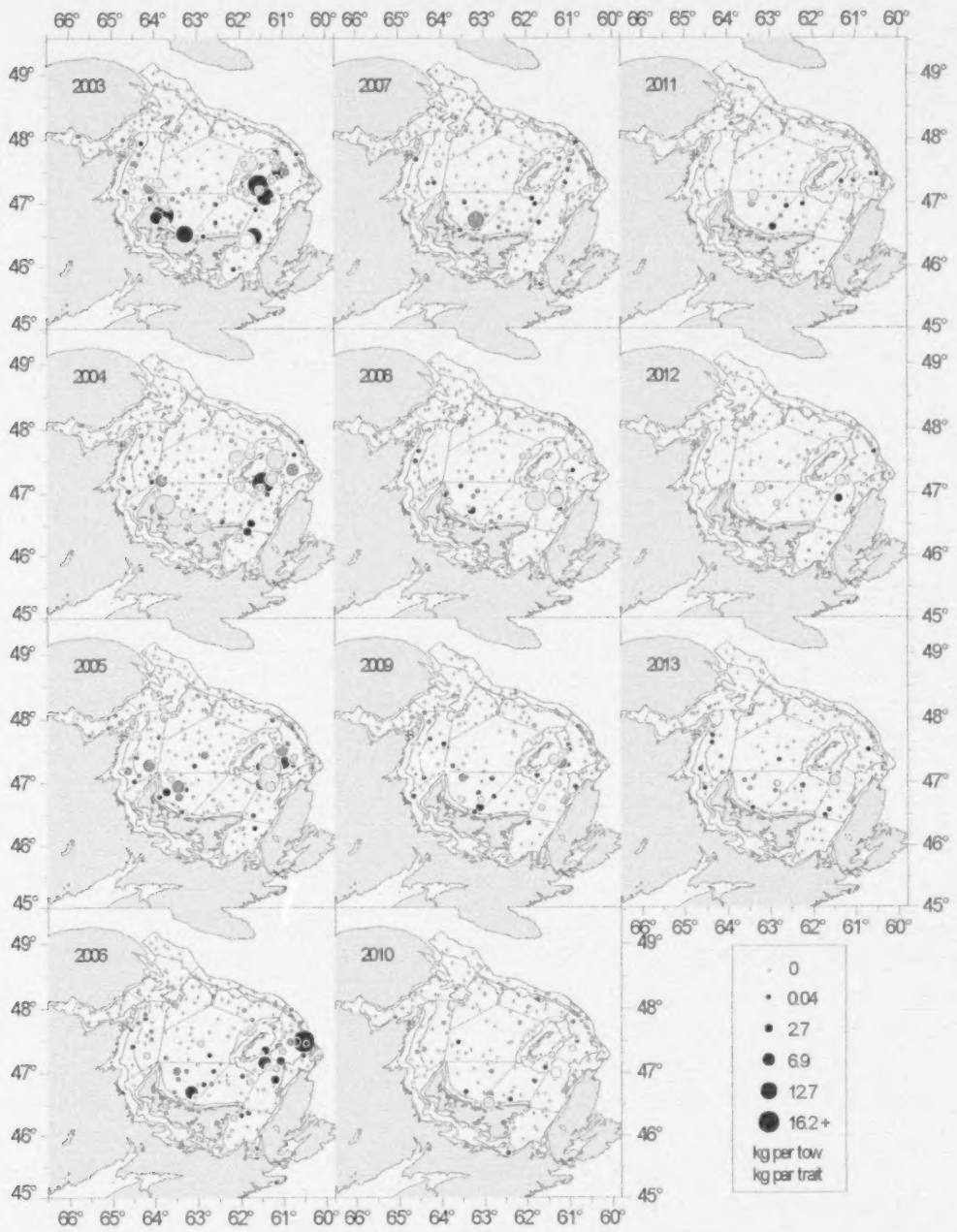

Figure 28. Yellowtail flounder catch indices (kilograms per standard tow) for each sentinel survey bottom-trawl set, 2003 to 2013. Each participating region is coded as follows: Prince Edward Island as black, Gaspe as dark grey, Magdalen Island as light grey and New Brunswick as white.

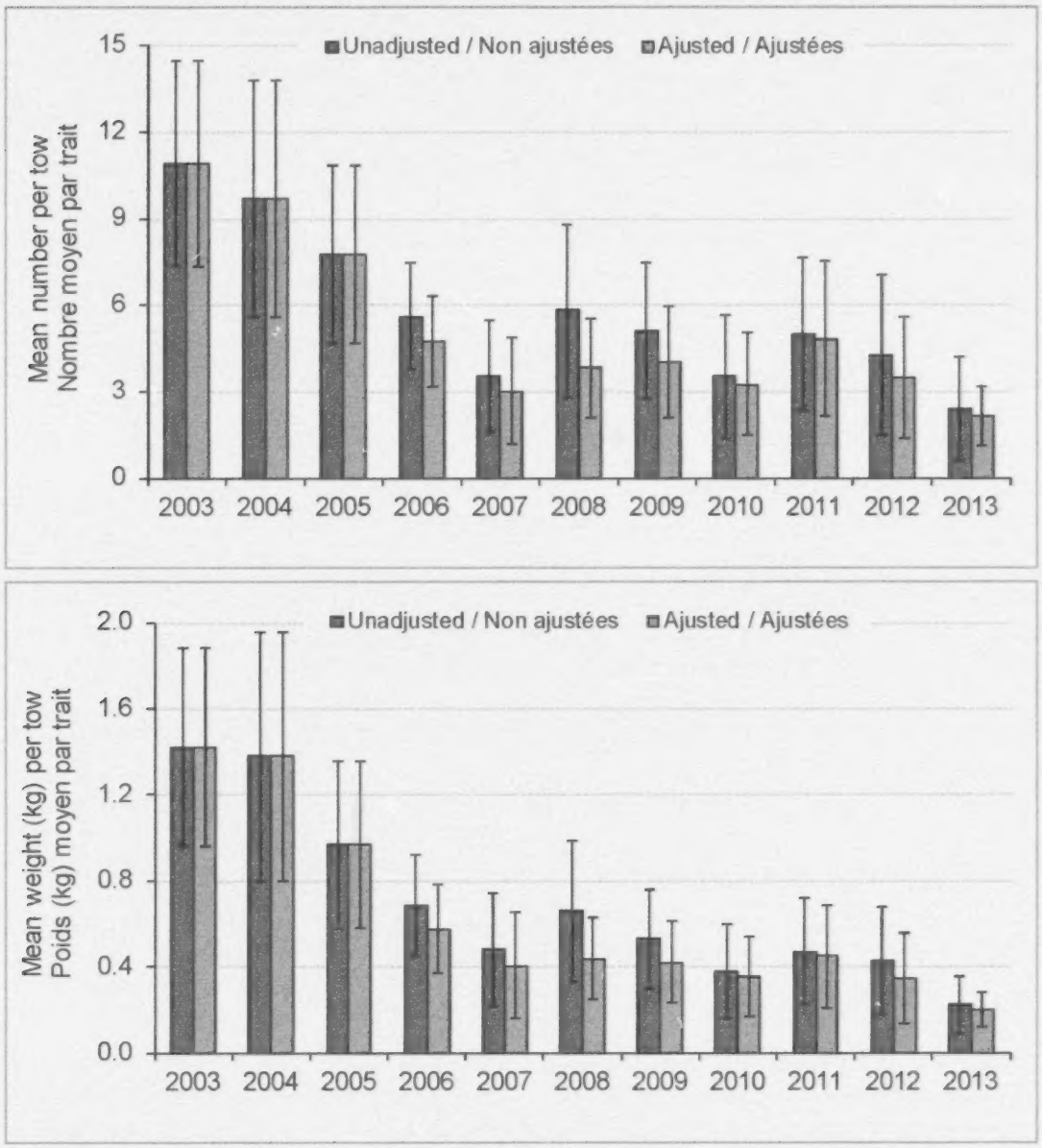

Figure 29. Mean annual indices in numbers (top) and weight (bottom) per tow of yellowtail flounder in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013. Adjusted values for vessel efficiency are represented by red bars, and unadjusted ones are represented by blue bars. Vertical lines denote approximate 95% confidence limits (± 2 standard errors).

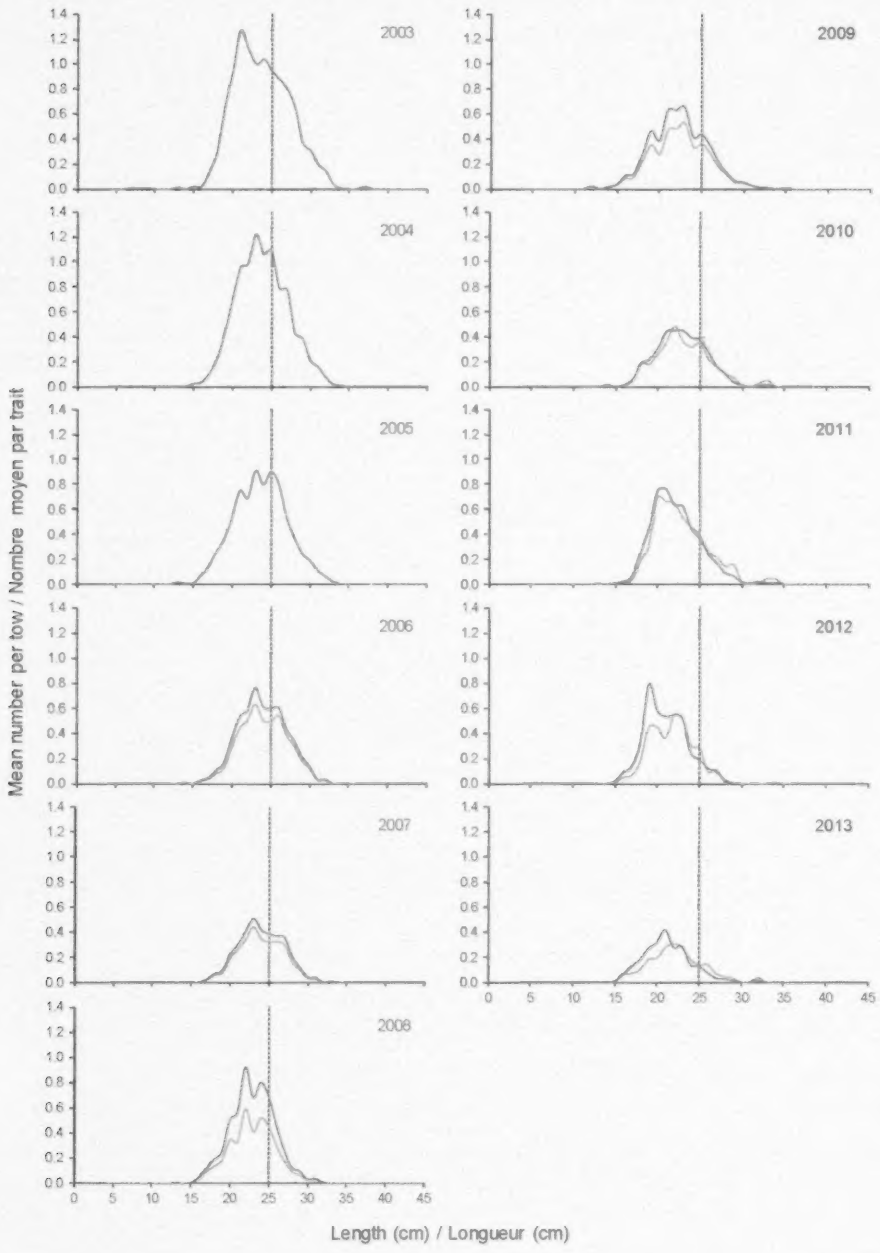

Figure 30. Annual overall yellowtail flounder length frequency distributions (expressed as mean number per tow) for the sentinel bottom-trawl surveys, 2003 to 2013. Adjusted values for vessel efficiency are represented by red lines, and unadjusted ones are represented by blue lines. The vertical dashed lines indicate the regulated minimum size of 25 cm for yellowtail flounder.

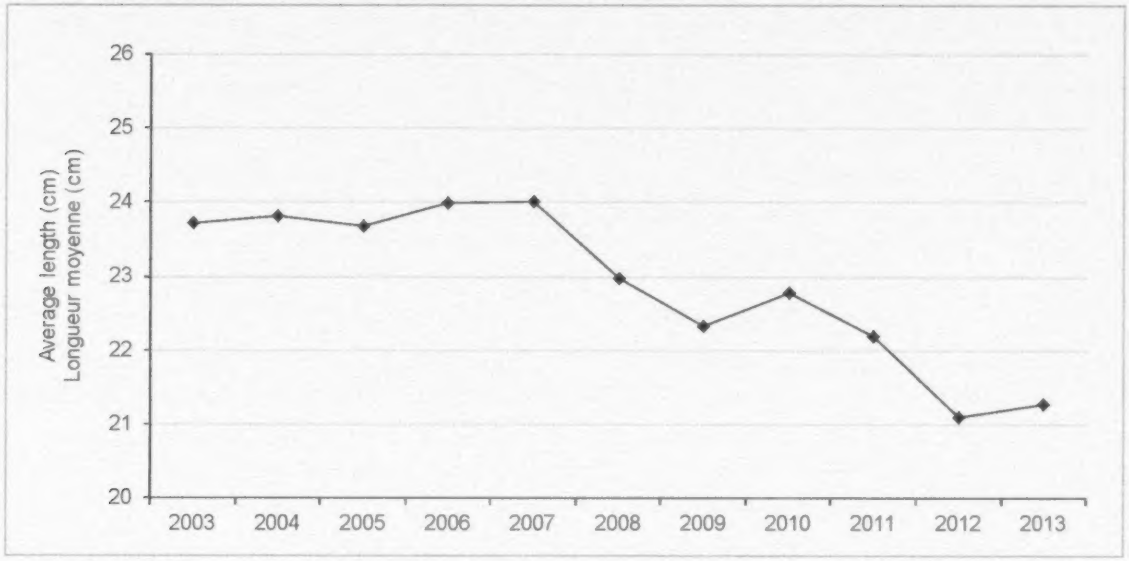

Figure 31. Annual mean length (cm) of yellowtail flounder in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013.

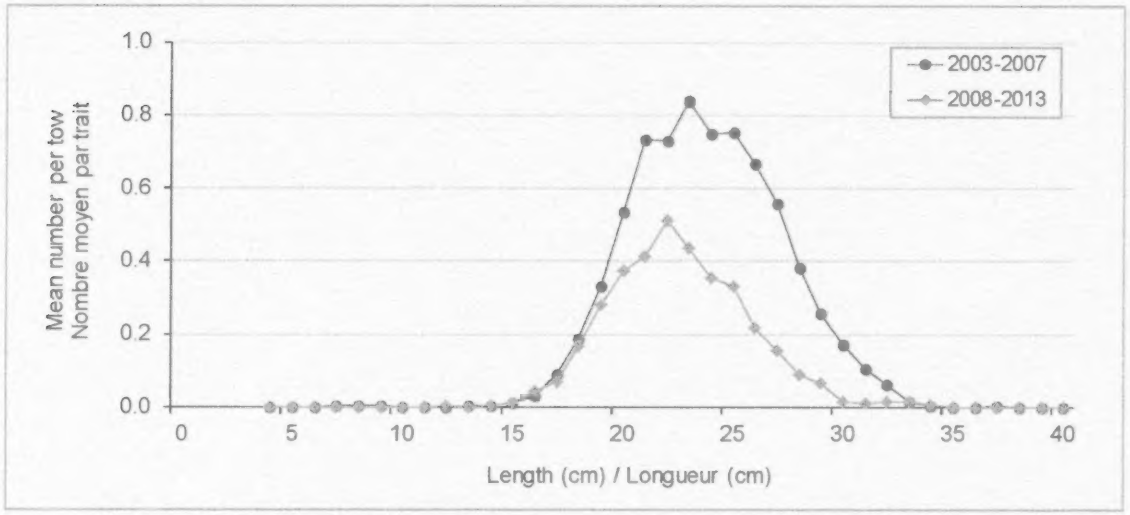

Figure 32. Average (expressed as mean number per tow) length frequency distributions of yellowtail flounder for two periods (2003-2007; 2008-2013) from the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence.

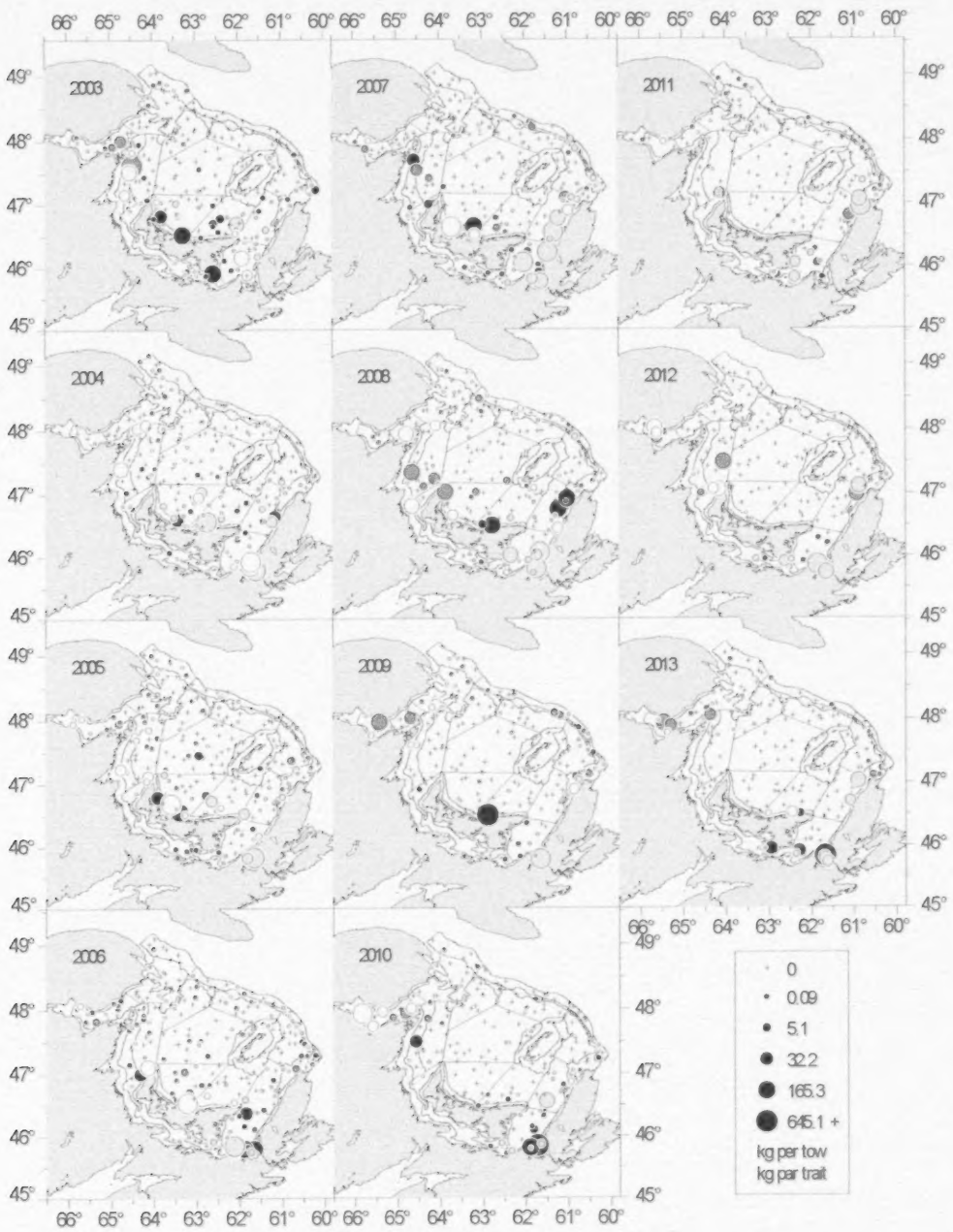

Figure 33. Atlantic herring catch indices (kilograms per standard tow) for each sentinel survey bottom-trawl set, 2003 to 2013. Each participating region is coded as follows: Prince Edward Island as black, Gaspe as dark grey, Magdalen Island as light grey and New Brunswick as white.

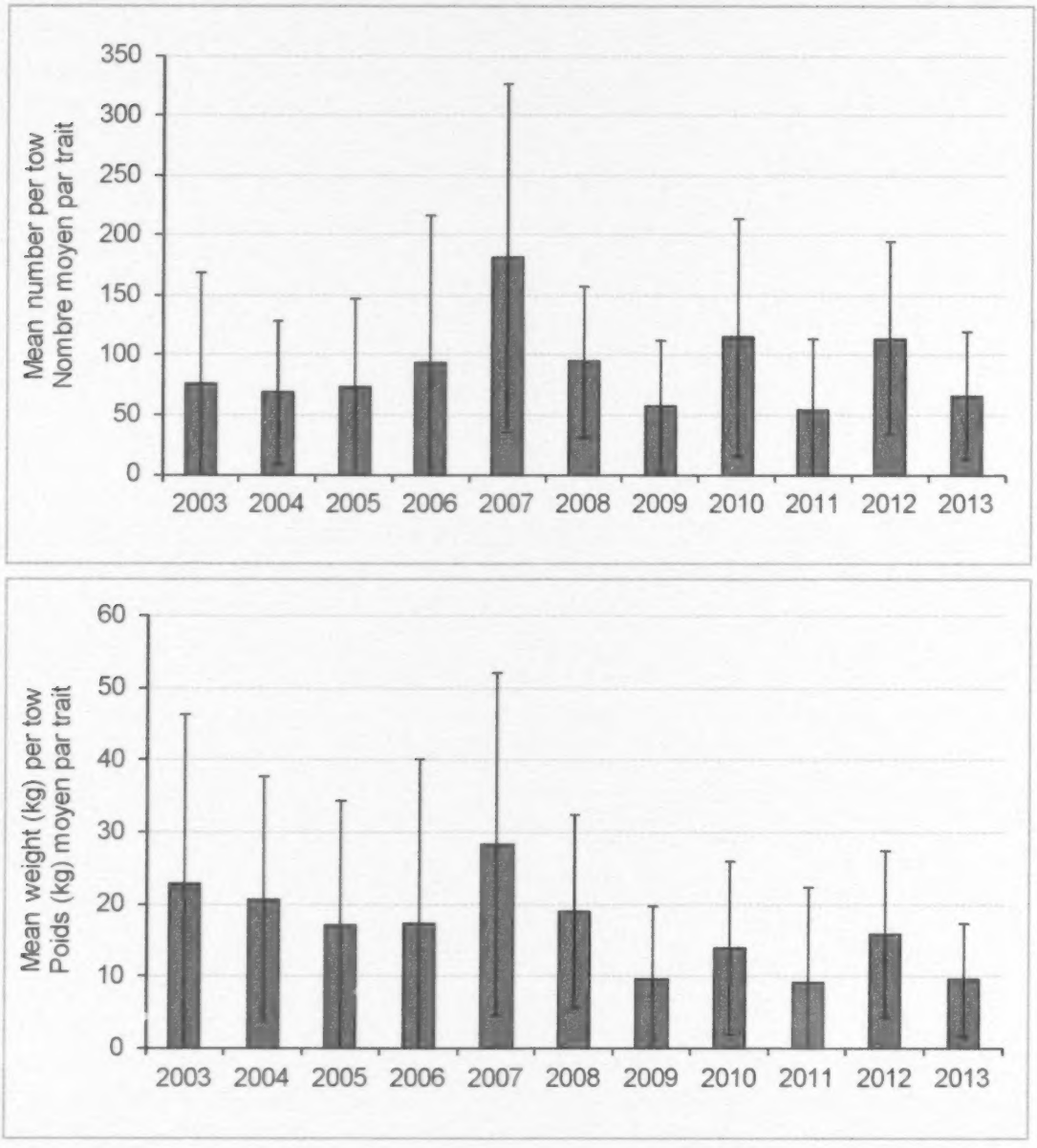

Figure 34. Mean annual indices as numbers (top) and weight (bottom) per tow of Atlantic herring in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013. Vertical lines denote approximate 95% confidence limits (± 2 standard errors).

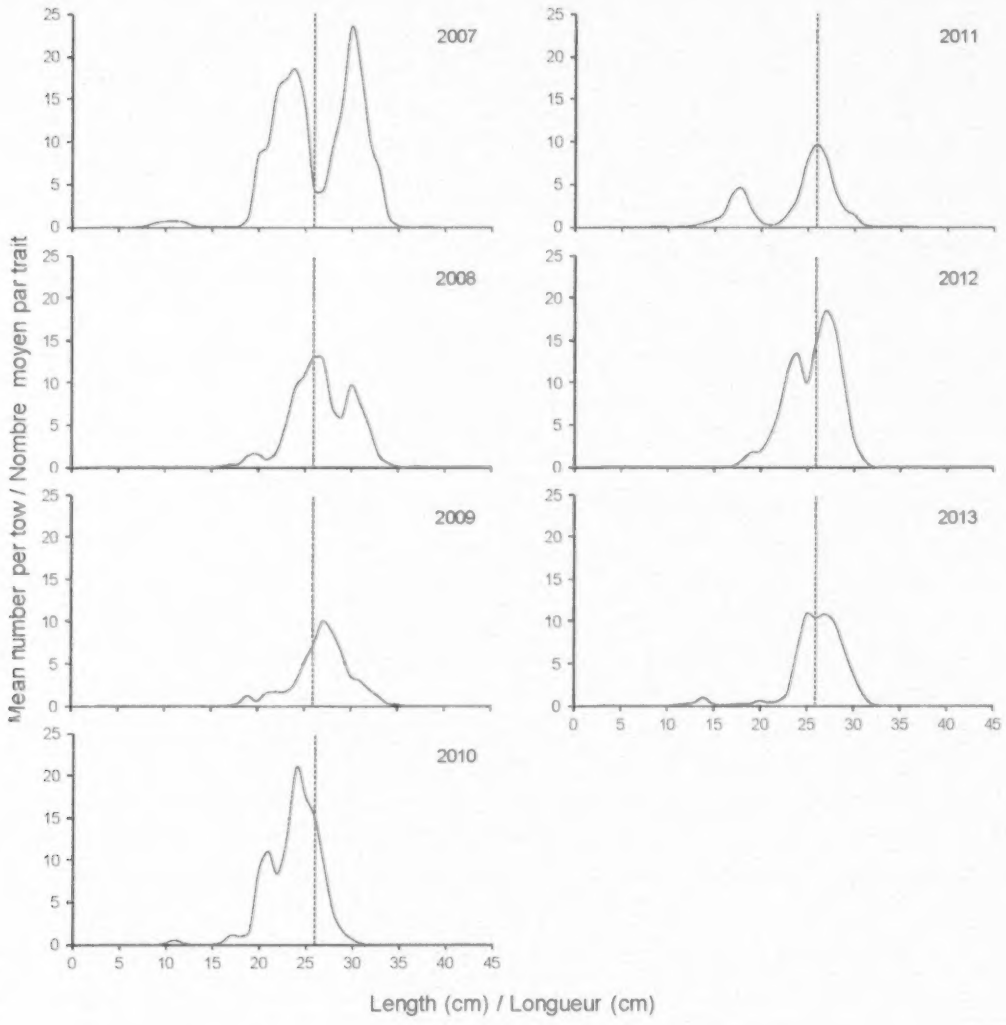

Figure 35. Annual overall Atlantic herring length frequency distributions (expressed as mean number per tow) for the sentinel bottom-trawl surveys, 2007 to 2013. The vertical dashed lines indicate the regulated minimum size of 26 cm for herring.

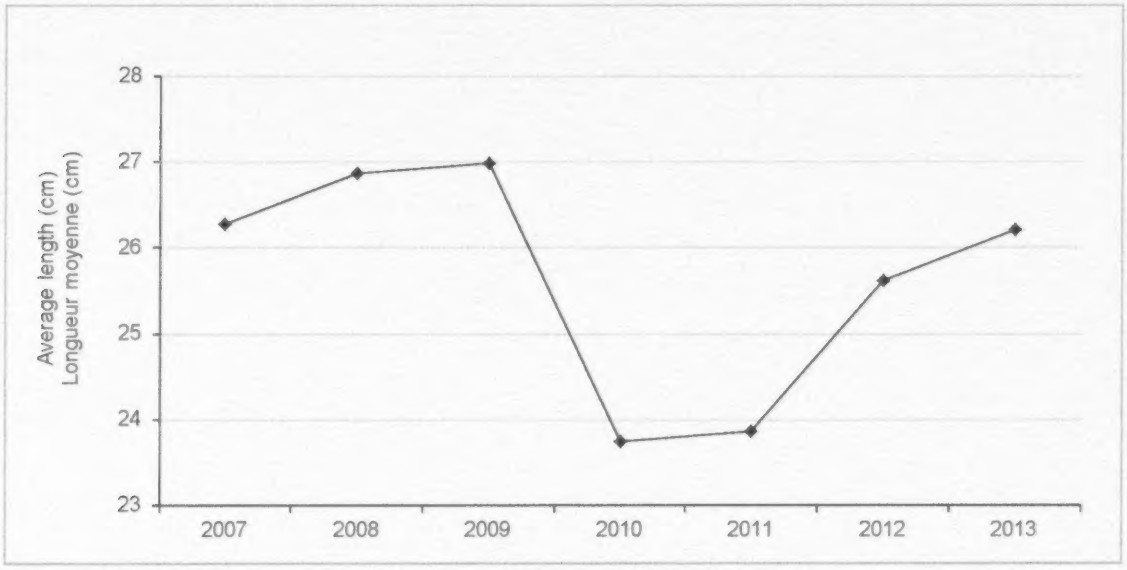

Figure 36. Annual mean length (cm) of Atlantic herring in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2007 to 2013.

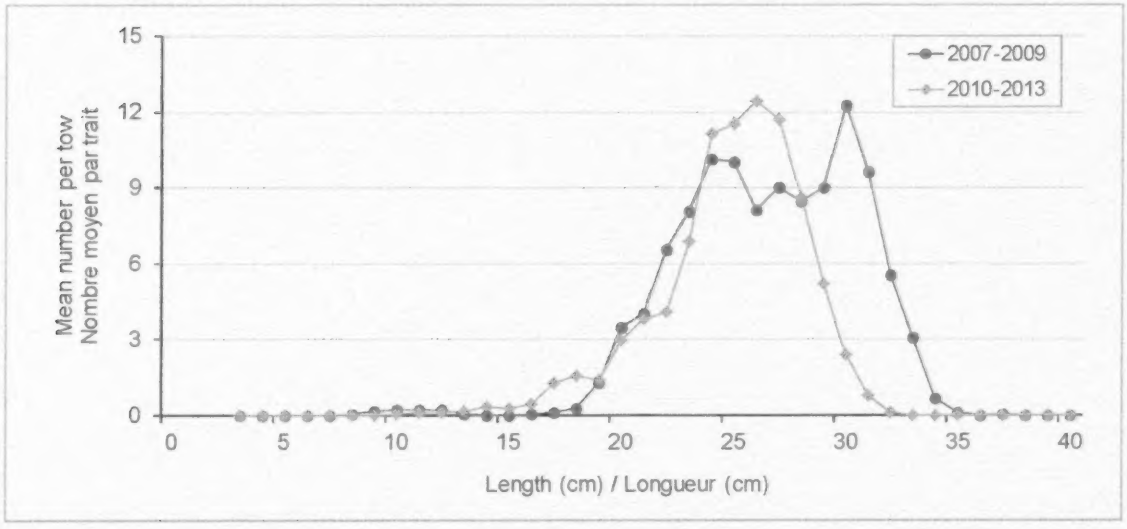

Figure 37. Average (expressed as mean number per tow) length frequency distributions of Atlantic herring for two time periods (2007-2009; 2010-2013) from the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence.

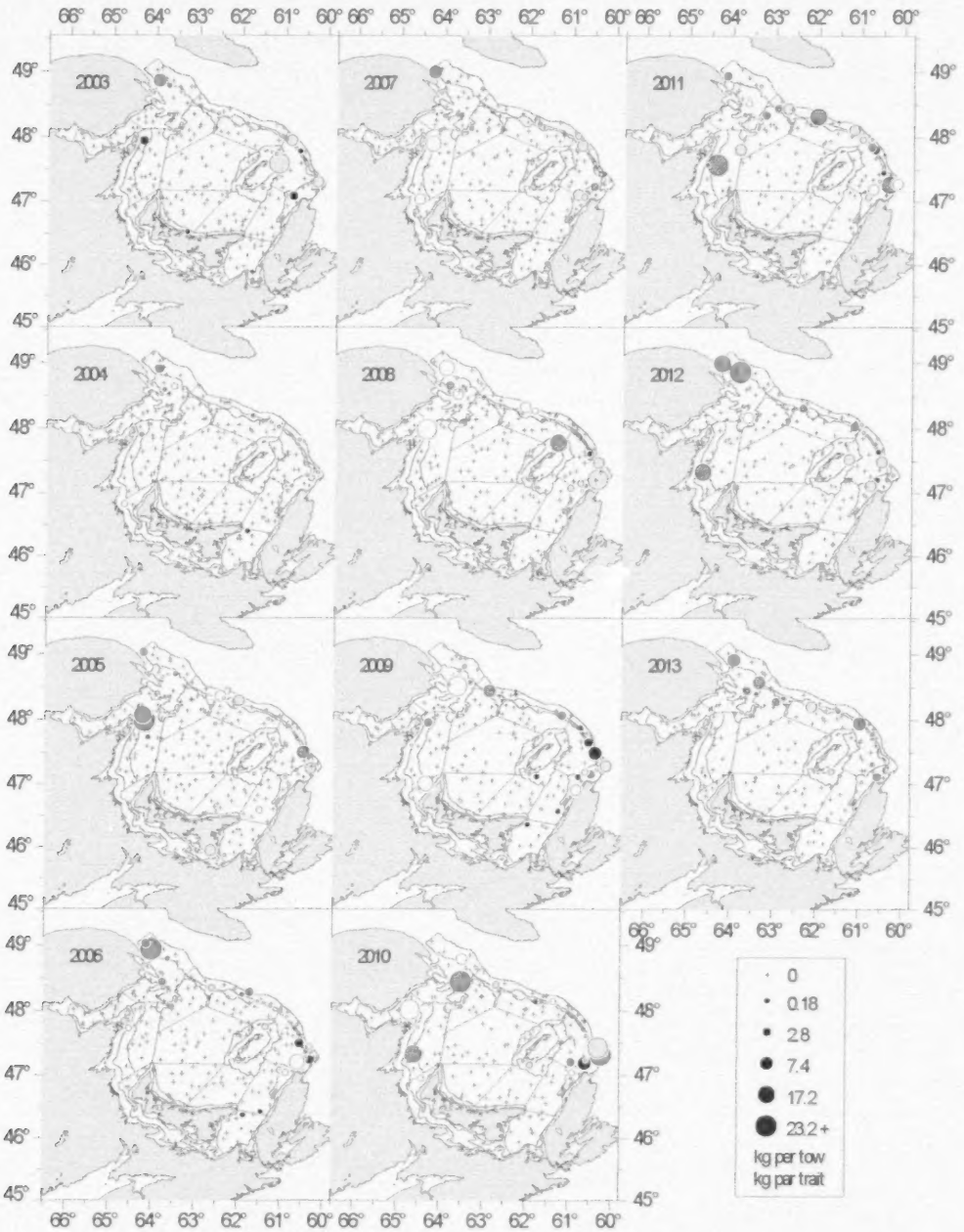

Figure 38. Atlantic halibut catch indices (kilograms per standard tow) for each sentinel survey bottom-trawl set, 2003 to 2013. Each participating region is coded as follows: Prince Edward Island as black, Gaspe as dark grey, Magdalen Island as light grey and New Brunswick as white.

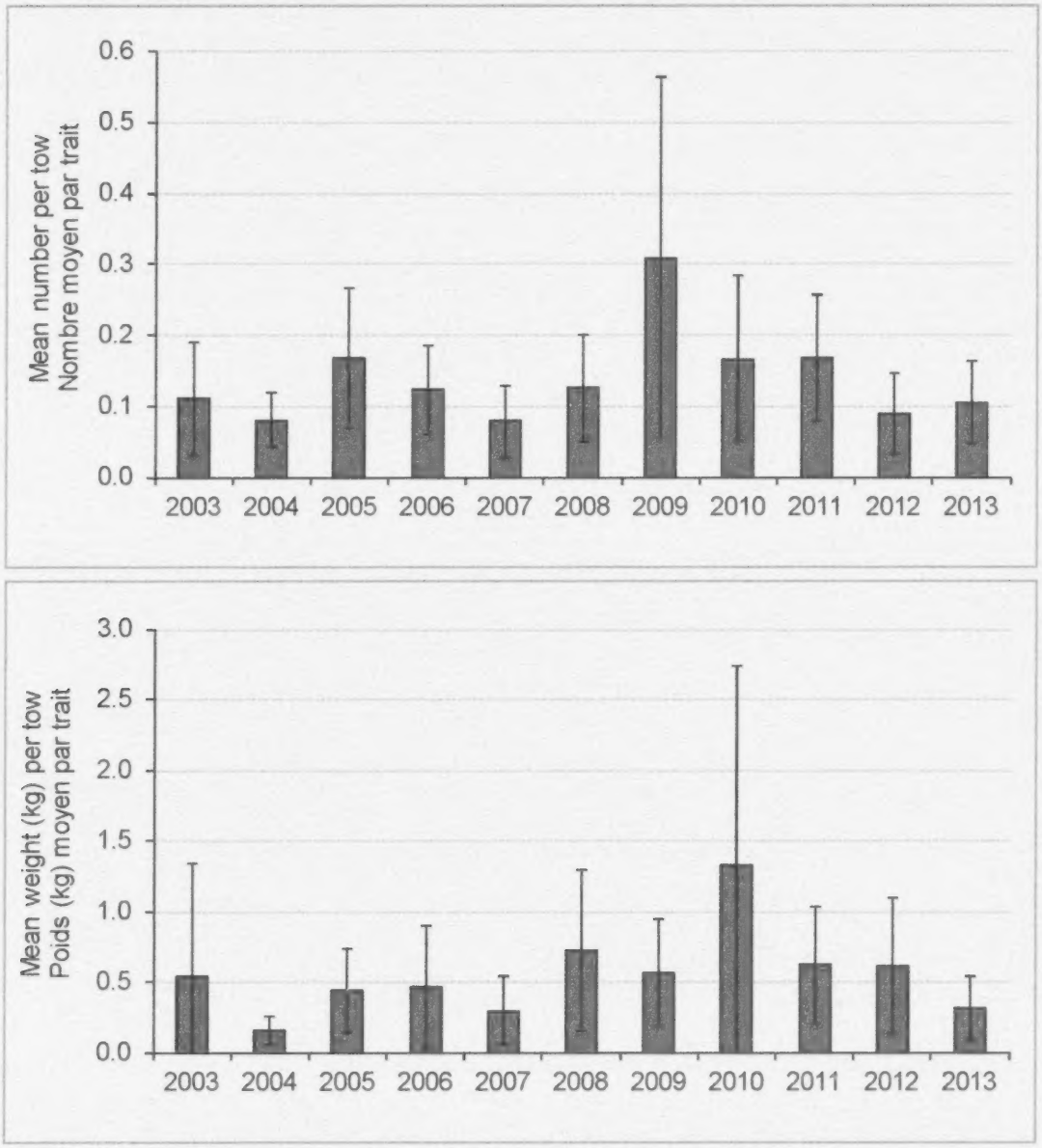

Figure 39. Mean annual indices by numbers (top) and weight (bottom) per tow of Atlantic halibut in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013. Vertical lines denote approximate 95% confidence limits (± 2 standard errors).

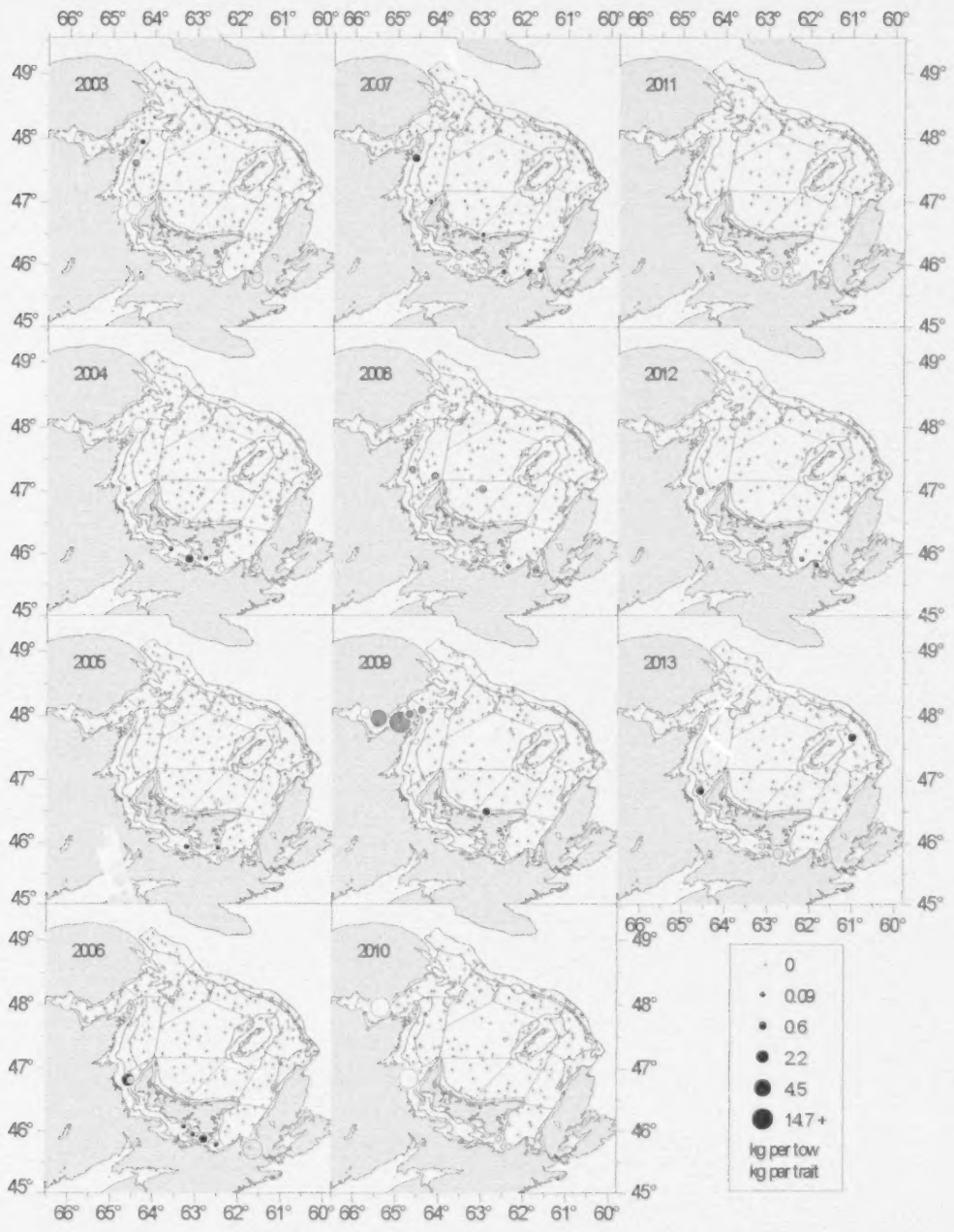

Figure 40. Gaspereau catch indices (kilograms per standard tow) for each sentinel survey bottom-trawl set, 2003 to 2013. Each participating region is coded as follows: Prince Edward Island as black, Gaspe as dark grey, Magdalen Island as light grey and New Brunswick as white.

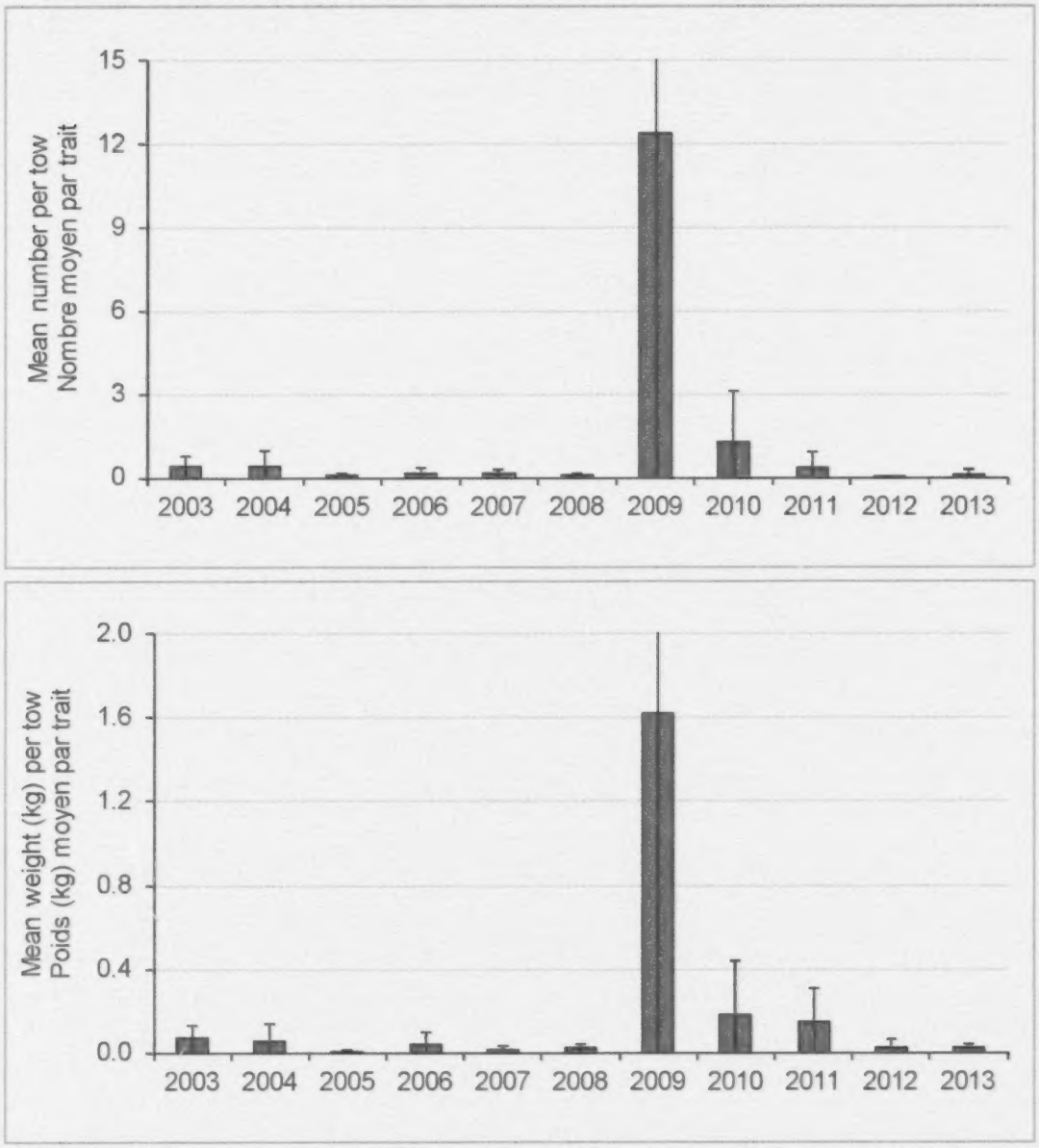

Figure 41. Mean annual indices by numbers (top) and weight (bottom) per tow of gaspereau in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013. Vertical lines denote approximate 95% confidence limits (± 2 standard errors).

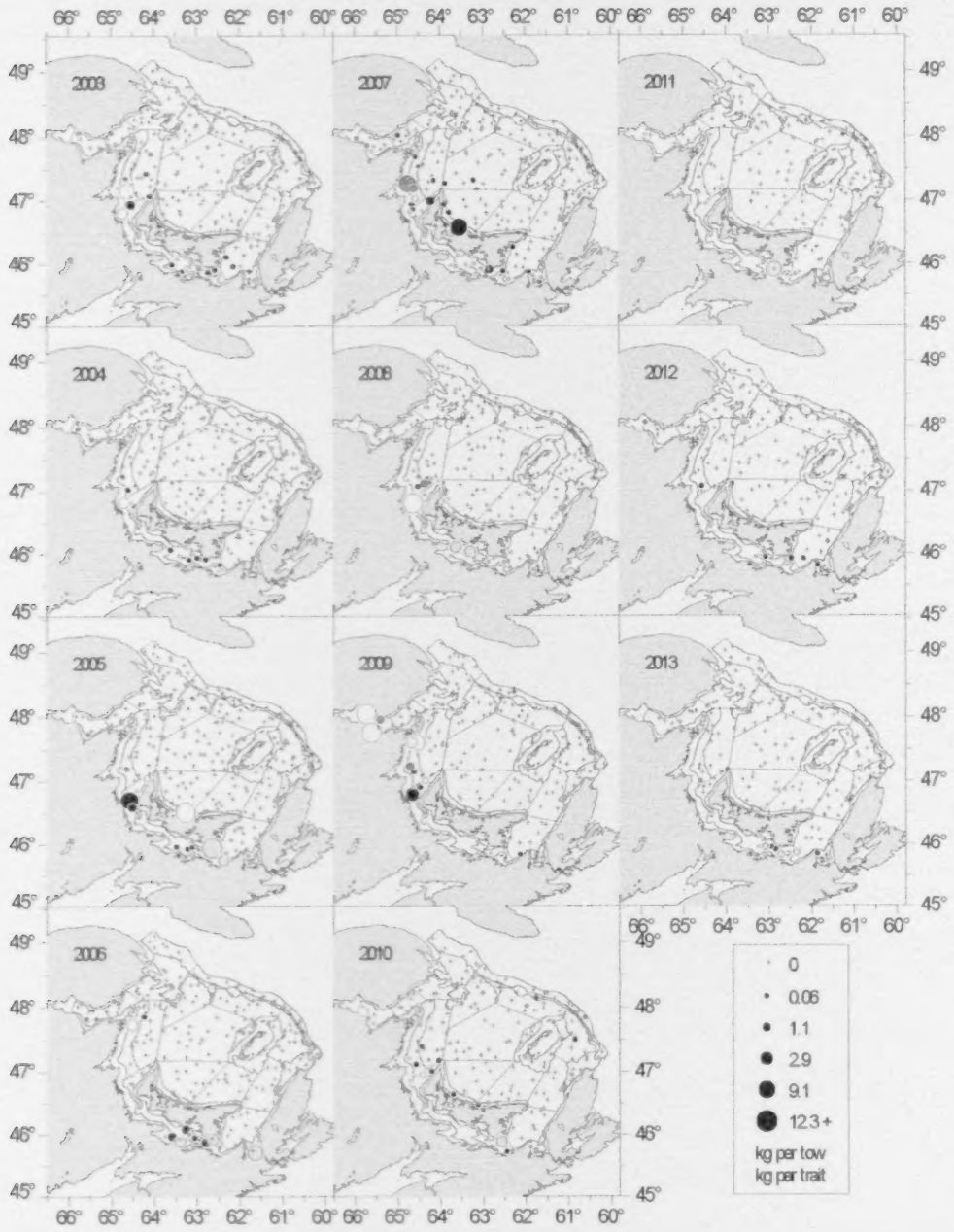

Figure 42. Rainbow smelt catch indices (kilograms per standard tow) for each sentinel survey bottom-trawl set, 2003 to 2013. Each participating region is coded as follows: Prince Edward Island as black, Gaspe as dark grey, Magdalen Island as light grey and New Brunswick as white.

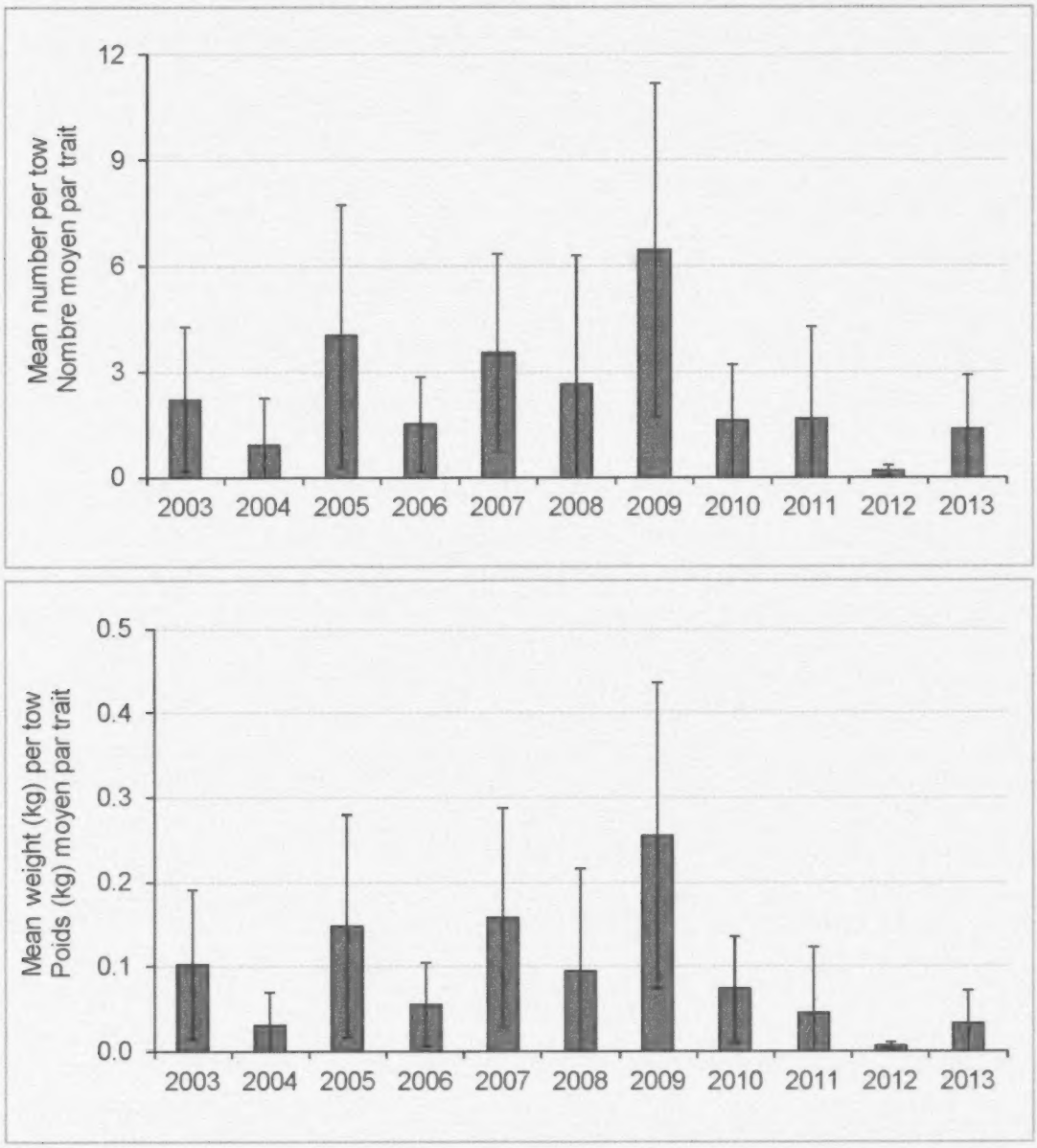

Figure 43. Mean annual indices as numbers (top) and weight (bottom) per tow of rainbow smelt in the sentinel bottom-trawl surveys of the southern Gulf of St. Lawrence, 2003 to 2013. Vertical lines denote approximate 95% confidence limits (± 2 standard errors).

APPENDICES

Appendix I. Total catches in numbers and weight by species during the sentinel bottom-trawl survey in the southern Gulf of St. Lawrence, August 2012. N/A means catches not counted.

Scientific Name	English Name	French Name	Number	Weight
Vertebrates				
Alosa pseudoharengus	Gaspereau	Gaspareau	7	7.1
Alosa sapidissima	American shad	Alose savoureuse	2	4.0
Amblyraja radiata	Thorny skate	Raie épineuse	42	42.0
Ammodytes americanus	American sand lance	Lançon d'amérique	504	12.7
Ammodytes dubius	Northern sand lance	Lançon du Nord	42	1.8
Bathyraja spinicauda	Spinytail skate	Raie à queue épineuse	3	3.1
Boreogadus saida	Artic cod	Morue arctique	3	0.1
Centroscyllium fabricii	Black dogfish	Aiguillat noir	1	2.0
Cetorhinus maximus	Basking shark	Requin pèlerin	1	2000.0
Clupea harengus	Atlantic herring	Hareng atlantique	47259	6619.1
Cyclopterus lumpus	Lumpfish	Grosse poule de mer	4	2.7
Eumesogrammus praecisus	Fourline snake blenny	Quatre-lignes atlantique	2	0.2
Eumicrotremus spinosus	Atlantic spiny lumpsucker	Petite poule de mer atlantique	3	0.3
Gadus morhua	Atlantic cod	Morue franche	5063	2467.4
Gadus ogac	Greenland cod	Ogac	3	1.7
Glyptocephalus cynoglossus	Witch flounder	Plie grise	439	123.1
Gymnocanthus tricuspis	Arctic staghorn sculpin	Tricorne arctique	35	3.1
Hemitripterus americanus	Sea raven	Hémitriptère atlantique	8	1.9
Hippoglossoides platessoides	American plaice	Plie canadienne	4121	714.2
Hippoglossus hippoglossus	Atlantic halibut	Flétan de l'atlantique	29	119.4
Leptagonus decagonus	Atlantic sea poacher	Agone atlantique	6	0.4
Leptoclinus maculatus	Daubed shanny	Lompénie tachetée	2	0.1
Limanda ferruginea	Yellowtail flounder	Limande à queue jaune	615	62.1
Liparis Fabricii	Gelatinous sea snail	Limace gélatineuse	1	0.1
Liparis gibbus	Dusky sea snail	Limace marbrée	15	1.6
Lophius americanus	Monkfish,goosefish,angler	Baudroie d'Amérique	1	1.0
Lycodes sp.	Eelpout unspecified	Lycode non spécifiée	12	5.3
Malacoraja senta	Smooth skate	Raie lisse	4	6.0
Mallotus villosus	Capelin	Capelan	2257	19.6
Melanogrammus aeglefinus	Haddock	Aiglefin	3	0.2
Melanostigma atlanticum	Atlantic soft pout	Molasse atlantic	1	0.1
Merluccius bilinearis	Silver hake	Merluche argenté	7	2.3
Microgadus tomcod	Atlantic tomcod	Poulamon atlantique	1	0.8
Myoxocephalus octodecemspinosus	Longhorn sculpin	Chaboisseau à dix-huit-épines	14	2.6
Myoxocephalus scorpius	Shorthorn sculpin	Chaboisseau à épines courtes	107	22.8
Myoxocephalus sp.	Sculpin unspecified	Chaboisseau non spécifiée	6	1.0
Nezumia bairdii	Marlin-spike grenadier	Grenadier du grand banc	5	1.0
Notolepis rissoi	White barracudina	Lussion blanc	4	0.4
Osmerus mordax mordax	Rainbow smelt	Éperlan d'amérique	39	1.2
Pettromyzon marinus	Sea lamprey	Grande lamproie marine	1	0.5
Phycis chesteri	Longfin hake	Merluche à longues nageoires	1	0.2
Pollachius virens	Pollock	Goberge	28	8.0
Pseudopleuronectes americanus	Winter flounder	Plie rouge	68	14.4
Rajidae (family)	Skates unspecified	Raies non spécifiée	2	1.0
Reinhardtius hippoglossoides	Turbot / greenland halibut	Flétan du Groenland	489	213.6
Scomber scombrus	Atlantic mackerel	Maquereau bleu	33	13.4
Sebastes sp.	Redfish unspecified	Sébaste non spécifié	1646	832.7
Triglops nybelini	Bigeye sculpin	Faux-trigle à grands yeux	1	0.1
Urophycis tenuis	White hake	Merluche blanche	185	79.1
Zoarces americanus	Ocean pout	Loquette d'amérique	9	4.6

Appendix I (continued).

Scientific Name	English Name	French Name	Number	Weight
Invertebrates				
Anthozoa (class)	Sea anemone unspecified	Anémone de mer non spécifiée	31	3.6
Argis dentata	Arctic argid	Crevette verte	N/A	0.3
Astarte sp.	*Astarte* sp.	Astartes sp.	3	0.6
Asterias sp.	Starfish unspecified	Étoile de mer non spécifiée	N/A	0.1
Asteroidea (class)	Starfish unspecified (class)	Étoile de mer non spécifiée (classe)	12	2.0
Boltenia sp.	Sea potato unspecified	Patate de mer non spécifiée	592	73.7
Buccinidae (family) *Eggs*	Whelk eggs unspecified	Œufs de buccin non spécifiés	N/A	0.1
Buccinum sp.	Whelk unspecified	Buccin non spécifié	8	0.9
Cancer irroratus	Atlantic rock crab	Crabe tourteau commun	1	0.2
Chionoecetes opilio	Snow crab (queen)	Crabe des neiges	179	55.7
Clypeasteroida (order)	Sand dollar unspecified	Clypéastre non spécifié	10	0.4
Crassostrea virginica	American cupped oyster	Huitre malpèque	2	0.4
Cucumaria frondosa	Sea cucumber	Holothurie	2	0.9
Duva multiflora	Sea cauliflower / soft coral	Main de mer	1	0.2
Gorgonocephalus sp.	Basket stars sp.	Gorgonocéphales sp.	41	7.8
Halocynthia pyriformis	Sea peach	Pêche de mer	25	1.8
Hippasteria phrygiana	Horse star	Hippasteria phrygiana	4	2.6
Holothuroidea (class)	Sea cucumber unspecified	Holothurie non spécifié	37	16.7
Homarus americanus	American lobster	Homard américain	172	64.7
Hyas araneus	Toad crab	Crabe lyre (araignée)	14	1.3
Hyas coarctatus	Lesser toad crab	Crabe lyre (arctique)	8	1.1
Illex illecebrosus	Short-fin squid	Encornet rouge nordique	43	4.5
Lithodes maja	Northern stone crab	Crabe épineux du nord	12	6.7
Loliginidae,ommastrephidae (family)	Squid unspecified	Encornet non spécifié	136	17.9
Mollusca (phylum)	Mollusks	Mollusques	2	0.2
Ophiopholis aculeata	Daisy	Ophiure	2	0.2
Paragus sp.	Hermit crabs	Bernards l'Hermite droitiers	1	0.1
Pandalus borealis	Northern shrimp	Crevette nordique	N/A	48.9
Pandalus montagui	Aesop shrimp	Crevette ésope	N/A	0.3
Pasiphaea multidentata	Pink glass shrimp	Sivade rose (crevette blanche)	N/A	0.2
Pennatula borealis	Sea pen	Plume de mer	31	1.0
Porifera (phylum)	Sponge unspecified	Éponge non spécifiée	43	21.5
Sclerocrangon boreas	Sculptured shrimp	Crevette de roche (ciselée)	N/A	0.4
Scyphozoa (class)	Jellyfish unspecified	Méduse non spécifiée	N/A	872.7
Solaster papposus	Spiny sun star	Soleil de mer épineux	3	1.2
Strongylocentrotus droebachiensis	Green sea urchin	Oursin vert	6	0.8
Strongylocentrotus sp.	Sea urchin unspecified	Oursin non spécifié	110	7.4
Other				
Foreign articles / garbage	Foreign articles / garbage	Déchets / résidus domestiques	N/A	8.1
Stones and rocks	Stones and rocks	Pierres et roches	N/A	67.3
Thallophyta (class)	Seaweed, algae, kelp	Goémon, algues, varech	N/A	3.2

Appendix II. Total catches in numbers and weight by species during the sentinel bottom-trawl survey in the southern Gulf of St. Lawrence, August 2013. N/A means catches not counted.

Scientific Name	English Name	French Name	Number	Weight
Vertebrates				
Alosa pseudoharengus	Gaspereau	Gaspareau	28	4.7
Alosa sapidissima	American shad	Alose savoureuse	4	0.6
Amblyraja radiata	Thorny skate	Raie épineuse	92	67.4
Ammodytes americanus	American sand lance	Lançon d'amérique	921	8.7
Ammodytessp.	Snd lance unspecified	Lançon non spécifié	168	0.6
Anarhichas lupus	Striped / Atlantic wolfish	Loup atlantique	1	1.0
Aspidophoroides monopterygius	Alligatorfish	Poisson alligator atlantique	1	0.1
Clupea harengus	Atlantic herring	Hareng atlantique	23499	3434.0
Cryptacanthodes maculatus	Wrymouth	Terrassier tacheté	1	1.0
Cyclopterus lumpus	Lumpfish	Grosse poule de mer	5	3.4
Eumicrotremus spinosus	Atlantic spiny lumpsucker	Petite poule de mer atlantique	1	0.1
Gadus morhua	Atlantic cod	Morue franche	3675	1607.0
Gadus ogac	Greenland cod	Ogac	3	0.6
Glyptocephalus cynoglossus	Witch flounder	Plie grise	382	102.1
Gymnocanthus tricuspis	Arctic staghorn sculpin	Tricorne arctique	21	1.5
Hemitripterus americanus	Sea raven	Hémitriptère atlantique	16	4.8
Hippoglossoides platessoides	American plaice	Plie canadienne	2022	344.8
Hippoglossus hippoglossus	Atlantic halibut	Flétan de l'atlantique	24	66.0
Leptagonus decagonus	Atlantic sea poacher	Agone atlantique	10	0.7
Limanda ferruginea	Yellowtail flounder	Limande à queue jaune	426	39.9
Liparis gibbus	Dusky sea snail	Limace marbrée	9	1.0
Lophius americanus	Monkfish,goosefish,angler	Baudroie d'Amérique	2	4.0
Lumpenus medius	Stout eelblenny	Lompénie naine	1	0.1
Lycenchelys verrilli	Wolf eelpout	Lycode à tête longue	1	0.1
Lycodes sp.	Eelpout unspecified	Lycode non spécifiée	8	3.8
Malacoraja senta	Smooth skate	Raie lisse	15	9.1
Mallotus villosus	Capelin	Capelan	634	48.7
Melanogrammus aeglefinus	Haddock	Aiglefin	10	2.6
Melanostigma atlanticum	Atlantic soft pout	Molasse atlantic	6	0.3
Merluccius bilinearis	Silver hake	Merluche argenté	8	1.6
Microgadus tomcod	Atlantic tomcod	Poulamon atlantique	1	1.0
Myoxocephalus octodecemspinosus	Longhorn sculpin	Chaboisseau à dix-huit-épines	20	11.4
Myoxocephalus scorpius	Shorthorn sculpin	Chaboisseau à épines courtes	32	13.9
Myoxocephalus sp.	Sculpin unspecified	Chaboisseau non spécifiée	1	0.2
Nezumia bairdii	Marlin-spike grenadier	Grenadier du grand banc	1	0.1
Notolepis rissoi	White barracudina	Lussion blanc	2	0.2
Osmerus mordax mordax	Rainbow smelt	Éperlan d'amérique	252	6.0
Phycis chesteri	Longfin hake	Merluche à longues nageoires	1	0.2
Pollachius virens	Pollock	Goberge	9	5.0
Pseudopleuronectes americanus	Winter flounder	Plie rouge	105	19.8
Reinhardtius hippoglossoides	Turbot / greenland halibut	Flétan du Groenland	224	132.5
Scomber scombrus	Atlantic mackerel	Maquereau bleu	93	18.4
Sebastes sp.	Redfish unspecified	Sébaste non spécifié	766	333.3
Tautogolabrus adspersus	Cunner	Tanche-tautogue	7	1.2
Urophycis tenuis	White hake	Merluche blanche	182	64.3
Zoarces americanus	Ocean pout	Loquette d'amérique	2	3.0

Appendix II (continued).

Scientific Name	English Name	French Name	Number	Weight
Invertebrates				
Anthozoa (class)	Sea anemone unspecified	Anémone de mer non spécifiée	25	6.8
Argis dentata	Arctic argid	Crevette verte	N/A	1.1
Asterias sp.	Starfish unspecified	Étoile de mer non spécifiée	4	0.6
Asterias vulgaris	Northern / Purple starfish	Etoile de mer pourpre	2	0.4
Asteroidea (class)	Starfish unspecified (class)	Étoile de mer non spécifiée (classe)	5	0.8
Bivalvia (class)	Bivalve unspecified (class)	Bivalve non spécifié (classe)	1	0.1
Boltenia sp.	Sea potato unspecified	Patate de mer non spécifiée	324	35.5
Buccinidae (family) *Eggs*	Whelk eggs unspecified	Œufs de buccin non spécifiés	N/A	4.5
Buccinum sp.	Whelk unspecified	Buccin non spécifié	10	1.0
Cancer irroratus	Atlantic rock crab	Crabe tourteau commun	13	2.0
Chionoecetes opilio	Snow crab (queen)	Crabe des neiges	178	90.1
Chlamys islandicus	Iceland scallop	Pétoncle d'Islande	1	0.1
Clypeasteroida (order)	Sand dollar unspecified	Clypéastre non spécifié	N/A	0.1
Crassostrea virginica	American cupped oyster	Huitre malpèque	1	0.1
Cucumaria frondosa	Sea cucumber	Holothurie	1	0.3
Decapoda (order)	Decapod unspecified (order)	Décapode non spécifié (ordre)	N/A	0.4
Gorgonocephalus sp.	Basket stars sp.	Gorgonocéphales sp.	75	17.5
Halocynthia pyriformis	Sea peach	Pêche de mer	3	0.1
Hippasteria phrygiana	Horse star	Hippasteria phrygiana	3	0.4
Holothuroidea (class)	Sea cucumber unspecified	Holothurie non spécifié	34	18.1
Homarus americanus	American lobster	Homard américain	491	219.8
Hyas araneus	Toad crab	Crabe lyre (araignée)	4	2.4
Hyas coarctatus	Lesser toad crab	Crabe lyre (arctique)	8	1.1
Illex illecebrosus	Short-fin squid	Encornet rouge nordique	1	0.1
Lithodes maja	Northern stone crab	Crabe épineux du nord	6	3.1
Loliginidae,ommastrephidae (family)	Squid unspecified	Encornet non spécifié	2	0.2
Mytilus edulis	Common mussels	Moule bleue	1	0.1
Paragus sp.	Hermit crabs	Bernards l'Hermite droitiers	2	0.1
Pandalus borealis	Northern shrimp	Crevette nordique	N/A	15.8
Pandalus montagui	Aesop shrimp	Crevette ésope	N/A	0.1
Pasiphaea multidentata	Pink glass shrimp	Sivade rose (crevette blanche)	N/A	0.2
Pennatula borealis	Sea pen	Plume de mer	105	22.6
Porifera (phylum)	Sponge unspecified	Éponge non spécifiée	38	6.7
Raja eggs	Skates eggs unspecified	Œufs de raie non spécifié	N/A	0.1
Sclerocrangon boreas	Sculptured shrimp	Crevette de roche (ciselée)	N/A	0.1
Scyphozoa (class)	Jellyfish unspecified	Méduse non spécifiée	N/A	1071.0
Solaster endeca	Smooth / purple sunstar	Soleil de mer pourpre	23	48.7
Solaster papposus	Spiny sun star	Soleil de mer épineux	8	0.9
Strongylocentrotus droebachiensis	Green sea urchin	Oursin vert	2	0.2
Strongylocentrotus sp.	Sea urchin unspecified	Oursin non spécifié	158	5.0
Other				
Foreign articles / garbage	Foreign articles / garbage	Déchets / résidus domestiques	N/A	0.4
Stones and rocks	Stones and rocks	Pierres et roches	N/A	21.0
Thallophyta (class)	Seaweed, algae, kelp	Goémon, algues, varech	N/A	15.9

Appendix IIIa. Summary statistics by stratum including number of valid sets and mean numbers and weights (per set) for Atlantic cod, white hake, American plaice, witch flounder, and winter flounder based on the August 2012 sentinel bottom-trawl survey of the southern Gulf of St. Lawrence. N/A means catches not counted or estimate not available.

Stratum	Number of valid sets	Atlantic cod (number)	Atlantic cod (kg)	White hake (number)	White hake (kg)	American plaice (number)	American plaice (kg)	Witch flounder (number)	Witch flounder (kg)	Winter flounder (number)	Winter flounder (kg)
401	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	1.75
402	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
403	4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	<0.1	1.7	0.3
415	7	75.8	67.7	1.9	1.3	0.5	7.0	4.9	1.5	0.0	0.0
416	8	57.8	27.1	0.0	0.0	0.2	2.1	42.3	6.2	0.0	0.0
417	6	10.6	7.6	0.2	0.7	0.0	0.0	16.5	2.9	0.0	0.0
418	5	3.8	2.7	0.0	0.0	0.0	0.0	36.3	6.3	0.2	<0.1
419	5	1.2	2.0	0.0	0.0	0.0	0.0	8.3	1.9	0.2	<0.1
420	7	3.8	0.6	0.0	0.0	0.3	2.9	0.0	0.0	1.1	0.2
421	4	2.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
422	7	16.1	9.9	0.0	0.0	0.0	0.0	63.5	9.2	0.2	0.1
423	14	2.0	2.4	0.0	0.0	0.0	0.0	78.9	13.7	0.0	0.0
424	8	22.9	11.6	0.0	0.0	0.0	0.0	82.4	12.5	0.0	0.0
425	8	0.2	0.2	2.9	2.6	0.0	0.0	0.0	0.0	0.0	0.0
426	7	57.8	23.6	0.0	0.0	0.4	1.1	0.7	0.2	0.0	0.0
427	7	4.0	1.4	0.0	0.0	0.0	0.0	0.6	0.1	0.0	0.0
428	3	0.9	0.2	0.0	0.0	0.0	0.0	1.1	0.3	0.6	0.1
429	9	4.2	3.5	0.0	0.0	0.0	0.0	30.5	4.9	0.2	0.1
431	9	2.8	2.4	0.0	0.0	0.0	0.0	19.8	2.8	0.0	0.0
432	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
433	8	0.1	0.1	0.1	0.1	0.0	0.0	4.5	1.2	0.2	0.1
434	8	6.0	3.3	0.1	0.1	0.0	0.0	55.4	10.6	0.3	0.1
435	4	7.0	0.4	0.0	0.0	0.2	2.0	0.2	0.1	4.0	0.9
436	8	7.0	2.7	0.0	0.0	0.0	0.0	8.5	1.8	0.7	0.1
437	8	138.9	109.2	14.6	2.9	0.9	1.5	11.6	1.8	0.0	0.0
438	6	355.7	77.9	0.0	0.0	1.5	2.3	25.1	8.3	0.0	0.0
439	9	2.5	0.9	3.2	2.3	0.3	0.4	3.1	0.9	0.0	0.0

Appendix IIIb. Summary statistics by stratum including number of valid sets and mean numbers and weights (per set) for yellowtail flounder, Atlantic halibut, Atlantic herring, gaspereau, and rainbow smelt based on the August 2012 sentinel bottom-trawl survey of the southern Gulf of St. Lawrence. N/A means catches not counted or estimate not available.

Stratum	Number of valid sets	Yellowtail flounder (number)	Yellowtail flounder (kg)	Atlantic halibut (number)	Atlantic halibut (kg)	Atlantic herring (number)	Atlantic herring (kg)	Gaspereau (number)	Gaspereau (kg)	Rainbow smelt (number)	Rainbow smelt (kg)
401	4	0.0	0.0	0.0	0.0	0.2	<0.1	0.0	0.0	0.0	0.0
402	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
403	4	0.0	0.0	0.0	0.0	6440.7	874.6	0.3	<0.1	1.0	0.1
415	7	12.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
416	8	2.2	0.7	0.0	0.0	0.1	<0.1	0.0	0.0	0.0	0.0
417	6	0.3	0.2	0.0	0.0	0.2	<0.1	0.0	0.0	0.0	0.0
418	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
419	5	0.0	0.0	0.0	0.0	497.4	91.1	0.0	0.0	0.2	<0.1
420	7	0.0	0.0	1.6	0.3	43.9	4.0	0.0	0.1	0.1	<0.1
421	4	0.0	0.0	0.0	0.0	818.3	80.2	0.0	0.0	0.0	0.0
422	7	0.0	0.0	0.0	0.0	435.2	56.8	0.0	0.0	0.0	0.0
423	14	0.2	0.2	2.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0
424	8	0.9	0.5	0.3	<0.1	0.0	0.0	0.0	0.0	0.0	0.0
425	8	3.8	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
426	7	1.4	0.4	0.0	0.0	1.0	0.2	0.0	0.0	0.0	0.0
427	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
428	3	0.0	0.0	6.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0
429	9	0.0	0.0	14.3	1.7	0.2	<0.1	0.0	0.0	0.4	<0.1
431	9	0.0	0.0	1.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0
432	4	0.0	0.0	0.0	0.0	321.2	35.5	0.9	1.4	8.5	0.2
433	8	0.0	0.0	0.2	<0.1	38.1	2.7	0.1	<0.1	0.4	<0.1
434	8	0.2	0.1	31.4	2.5	0.1	<0.1	0.0	0.0	0.0	0.0
435	4	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0
436	8	0.8	0.3	12.3	1.2	0.0	0.0	0.0	0.0	0.0	0.0
437	8	17.0	5.4	0.0	0.0	904.0	151.6	0.1	<0.1	0.0	0.0
438	6	8.8	2.7	8.5	1.1	0.0	0.0	0.0	0.0	0.0	0.0
439	9	10.7	2.6	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0

Appendix IVa. Summary statistics by stratum including number of valid sets and mean numbers and weights (per set) for Atlantic cod, white hake, American plaice, witch flounder, and winter flounder based on the August 2013 sentinel bottom-trawl survey of the southern Gulf of St. Lawrence. N/A means catches not counted or estimate not available.

Stratum	Number of valid sets	Atlantic cod (number)	Atlantic cod (kg)	White hake (number)	White hake (kg)	American plaice (number)	American plaice (kg)	Witch flounder (number)	Witch flounder (kg)	Winter flounder (number)	Winter flounder (kg)
401	4	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.6
402	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
403	4	0.0	0.0	0.2	<0.1	0.2	0.2	0.0	0.0	2.3	0.4
415	7	2.0	1.8	1.0	1.0	0.4	2.0	0.9	0.2	0.0	0.0
416	7	147.0	77.2	0.3	0.2	0.6	2.1	29.2	3.8	0.0	0.0
417	5	5.9	5.8	0.0	0.0	0.0	0.0	15.6	1.8	0.0	0.0
418	5	3.6	4.3	0.0	0.0	0.0	0.0	25.6	4.8	0.0	0.0
419	4	2.2	2.7	0.0	0.0	0.0	0.0	6.5	1.5	0.0	0.0
420	7	0.7	0.2	0.0	0.0	0.0	0.0	4.2	0.8	1.3	0.3
421	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
422	9	18.6	13.2	0.0	0.0	0.0	0.0	38.6	5.7	0.3	0.1
423	13	1.9	1.0	0.0	0.0	0.0	0.0	10.4	1.7	0.0	0.0
424	8	43.8	18.6	0.0	0.0	0.2	0.4	21.3	3.4	0.0	0.0
425	5	5.0	0.9	11.3	3.6	0.0	0.0	1.3	0.3	0.0	0.0
426	5	158.9	68.0	0.0	0.0	0.8	2.0	12.3	1.9	0.0	0.0
427	8	2.0	0.5	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.0
428	3	0.6	0.2	0.0	0.0	0.0	0.0	0.9	0.2	0.0	0.0
429	10	2.9	2.4	0.0	0.0	0.0	0.0	19.2	3.5	0.2	<0.1
431	10	3.5	1.4	0.0	0.0	0.0	0.0	5.8	1.1	0.1	<0.1
432	4	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	1.5	0.1
433	7	0.2	<0.1	0.3	<0.1	0.0	0.0	1.0	0.2	1.7	0.2
434	9	6.6	2.3	0.0	0.0	0.0	0.0	11.2	2.3	0.3	0.1
435	4	149.8	19.2	0.0	0.0	0.2	1.2	2.0	0.4	13.0	2.8
436	8	11.1	4.2	0.4	0.1	0.1	0.1	9.0	1.6	0.7	0.1
437	8	19.3	9.9	10.7	3.1	0.6	0.7	29.4	4.1	0.0	0.0
438	6	26.2	8.9	0.0	0.0	0.5	1.9	27.8	7.4	0.0	0.0
439	6	14.4	11.4	3.2	1.8	0.2	0.1	1.2	0.2	0.0	0.0

Appendix IVb. Summary statistics by stratum including number of valid sets and mean numbers and weights (per set) for yellowtail flounder, Atlantic halibut, Atlantic herring, gaspereau, and rainbow smelt based on the August 2013 sentinel bottom-trawl survey of the southern Gulf of St. Lawrence. N/A means catches not counted or estimate not available.

Stratum	Number of valid sets	Yellowtail flounder (number)	Yellowtail flounder (kg)	Atlantic halibut (number)	Atlantic halibut (kg)	Atlantic herring (number)	Atlantic herring (kg)	Gaspereau (number)	Gaspereau (kg)	Rainbow smelt (number)	Rainbow smelt (kg)
401	4	0.0	0.0	1.0	0.1	162.0	22.5	0.0	0.0	0.0	0.0
402	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
403	4	0.0	0.0	0.0	0.0	4260.8	644.3	0.4	<0.1	7.6	0.2
415	7	8.9	2.1	0.0	0.0	0.1	<0.1	0.0	0.0	0.0	0.0
416	7	3.9	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
417	5	0.0	0.0	0.0	0.0	1.8	0.2	0.0	0.0	0.0	0.0
418	5	0.0	0.0	0.0	0.0	0.6	0.1	0.0	0.0	0.0	0.0
419	4	0.0	0.0	0.0	0.0	427.6	81.9	0.0	0.0	0.0	0.0
420	7	0.0	0.0	0.6	0.1	107.3	15.4	0.0	0.0	0.1	<0.1
421	4	0.0	0.0	0.3	0.1	0.0	0.0	0.2	0.2	0.0	0.0
422	9	0.6	0.2	1.1	0.1	1.1	0.2	0.0	0.0	0.0	0.0
423	13	0.0	0.0	0.7	<0.1	0.0	0.0	0.0	0.0	0.0	0.0
424	8	0.4	0.1	0.0	0.0	1.4	0.4	0.0	0.0	0.0	0.0
425	5	4.5	0.9	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.0
426	5	4.9	1.5	0.0	0.0	0.8	0.2	0.0	0.0	0.0	0.0
427	8	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
428	3	0.0	0.0	18.2	1.4	0.0	0.0	0.0	0.0	0.0	0.0
429	10	0.0	0.0	4.9	0.7	0.0	0.0	0.0	0.0	0.0	0.0
431	10	0.0	0.0	1.4	0.2	12.5	1.5	0.0	0.0	0.0	0.0
432	4	0.0	0.0	0.0	0.0	151.2	17.7	7.6	1.0	45.3	0.9
433	7	0.0	0.0	0.0	0.0	220.2	21.8	0.0	0.0	11.5	0.3
434	9	0.0	0.0	18.5	1.3	0.0	0.0	0.0	0.0	0.0	0.0
435	4	0.0	0.0	5.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0
436	8	3.4	0.8	3.8	0.3	1.9	0.3	0.1	0.1	0.0	0.0
437	8	14.1	3.5	0.0	0.0	499.8	67.9	0.0	0.0	0.0	0.0
438	6	10.3	3.2	9.3	1.1	0.0	0.0	0.0	0.0	0.0	0.0
439	6	4.6	1.6	0.0	0.0	1.7	0.2	0.0	0.0	0.0	0.0